DOCUMENT RESUME

ED 230 391 SE 041 591

AUTHOR Bandhu, Desh, Ed.; Ramanathan, N. L., Ed.
TITLE Education for Environmental Planning and Conservation.
INSTITUTION Indian Environmental Society, New Delhi.
PUB DATE 82
NOTE 488p.; Edited Proceedings of the International Conference on Environmental Education organized by Indian Environmental Society and Department of Environment (New Delhi, India, December 16-20, 1981).
AVAILABLE FROM Indian Environmental Society, 8, Darya Ganj, New Delhi-110002 (India).
PUB TYPE Books (010) -- Collected Works - Conference Proceedings (021) -- Reports - Descriptive (141)

EDRS PRICE MF02 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Conservation (Environment); Curriculum Development; *Educational Trends; *Environmental Education; Environmental Standards; Foreign Countries; *Institutional Role; Natural Resources; *Physical Environment; Pollution; Population Education; *Program Descriptions; Program Development; Science Education; *Teacher Education; Teaching Methods
IDENTIFIERS *Environmental Planning Education; Environmental Problems

ABSTRACT

Presented in these proceedings are the inaugural and presidential addresses, 8 keynote addresses, and 40 contributed papers presented at an international conference on environmental education (EE). Conference recommendations, a synopsis of conference themes/thrusts, resolution on the organization of a national environmental congress, and the Delhi Declaration on Environmental Education are also presented. The conference addressed a wide range of topics relevant to EE training, orientation, awareness, and research. These topics included: assessment of philosophy of EE in the tropics; introduction of nuclear power in the Philippines; food or fuel; women and energy; role of universities in EE; role of research and development institutions in EE; fundamentals in teacher preparation and curriculum development for EE; identification of psychological, cultural, and physical materials for EE; proposal for mass education of environment; strategies for using extra-curricular activities in science for spread [illegible]f EE; population education and its relationship to EE; marine poll[illegible]on; social fencing and institutionalization of green gold farming in the Himalayas; poverty and environment; and others. In addition, EE programs, activities, and experiences unique to specific foreign countries are discussed. Countries include Indonesia, Japan, Malaysia, Philippines, Sri Lanka, Thailand, and India. (JN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

Education for Environmental Planning and Conservation

(Edited Proceedings of the International Conference
on Environmental Education Organised by
Indian Environmental Society and
Department of Environment)

ED230391

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

✓ This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.

- Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

Editors
DESH BANDHU
N.L. RAMANATHAN

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY
Desh Bandhu

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

SE041591

INDIAN ENVIRONMENTAL SOCIETY

This Publication can be obtained from:

Indian Environmental Society
8, Darya Ganj, New Delhi-110002 (INDIA)

First Published 1982

© Indian Environmental Society

Printed in India by Satish Composing Agency at Times Press, New Delhi.

Foreword

The United Nations Conference on the Human Environment held at Stockholm in 1972 helped to focus world attention on the dangers to human survival and quality of life posed by the continuous degradation of basic ecological assets. It is now widely realized that ecological security is the only foundation on which enduring national and global food security systems can be built. In spite of this awareness, man-made causes are accelerating and spreading eco-catastrophes.

The world has witnessed a doubling of grain output in the last 30 years. It is, however, seldom realized that progress in food production has been accompanied by various forms of abuse of land. The United States Department of Agriculture has estimated that the inherent productivity of about 34 per cent of U.S. cropland is now falling because of effective loss of top soil. Water erosion aggravates soil loss. Shortage of firewood is leading to rapid deforestation, leading to greater soil erosion. Different forms of desertification leading to either the dimunition or destruction of the biological potential of land occur in both developing and developed countries. A recent U.N. report indicates that one-tenth of world's total irrigated area is water-logged. A considerable segment of the irrigated area affected by problems of salinity and alkalinity. In India, most of the fertile top soil is also lost in the process of brick making.

Compounding these problems is the conversion of cropland to non-farm uses arising from urban expansion, highway construction, industrialization, etc. Demographers expect that the world's urban population may increase from 1.18 to 3.16 billion in 2000 AD. Habitat destruction also leads to the loss of genetic resources of plants and animals. Thus posterity will be deprived of the fruits of thousands of years of natural and human selection in living organims. The steady increase in the carbon dioxide concentration of the atmosphere has serious long-term implications with reference to climate.

Education is essential for generating widespread awareness of environmental problems. Awareness is essential for action. Without proper educational efforts the awareness-analysis-action chain does not move smoothly and effectively. The purpose of the International Conference on Environmental Education was to promote awareness and analysis. The proceedings of this Conference contain a wealth of valuable information and I hope they will stimulate people's action in the protection of the environment.

I wish to thank Dr. Desh Bandhu and his colleagues for the trouble they have taken to put together the proceedings of the Conference.

M.S. Swaminathan
Director General
The International Rice Research Institute

Preface

"आ नो भद्रः क्रतवो यन्तु विश्वतः । "

This aphorism from the Rig Veda freely translated means:

"Let knowledge come to us from all the sides". Here "all sides" must imply the circumscribing surroundings or the environment according to our ancient sages. Experiences *in*, *about*, *from* and *with* the dynamic environment provided the basis for man's earliest concepts of all sciences, art and social values. Environment has been man's pre-eminent teacher and is so even today. Mankind would never have got anywhere without this vital knowledge about environmental phenomena.

Environmental Education means many things to many people. Learning *from* the environment as implied by the aphorism, learning *about* the environment and its wondrous ecological fabric and learning *for* the environment for protecting and preserving its resources for sustained development are facets of worthwhile environmental education. Then again, all teachers consider the environment as a subject fit for the classroom, but some want environment taught as separate discipline while others would have it integrated into the teaching curriculum. There are yet others who opt for a non-formal approach for imparting education about environment. Mass-media men see it as a challenge to broadcast environmental awareness among the general public, with its myriad cultures, social mores, faiths, beliefs, superstitions, and not the least languages. All these strategies are important and should be used opprotunately.

The Delhi International Conference on Environmental Education has been a cauldron into which all this unlimited variety of views and approaches were thrown in, heated and homogenized, spiced and simmered, till the essence of the deliberations was served up as the "Delhi Declaration on Environmental Education". For once, it can be said that too many cooks created a delicious broth.

It is true that several experts and countless participants and observers contributed significantly to this Conference. But the one outstanding, non-pareil cohesive force that must be singled out for the outcome of the Conference is Dr. M.S. Swaminathan, Member for Science in the Planning Commission, Government of India. He set the tone of the Conference in a harmonious key in his welcome address and put the seal of general approbation in his concluding address. The result is this Proceedings, which has his blessings.

The Editors of this Proceedings are indeed grateful to the contributors of the learned papers for sending in more or less finished articles in time and to those who helped in the production of this volume within the record time of ten months.

Environment is there, with all its complexity, for all living organisms to be part of, to draw sustenance from and to reorganise and recycle till eternity. Environment is indivisible and inseparable from life. To comprehend the totality of the environment may appear beyond man's present ken, but environmental education must strive to present on all round vision to the future generations.

Environmental education, we believe, would persuade all concerned to become actively involved in the conservation and enrichment of the environment.

November, 1982 —**Editors**

Contents

Page

INAUGURAL ADDRESS 1
B.P. Pal

PRESIDENT'S ADDRESS 9
C.P.N. Singh

SYNOPSIS OF THE CONFERENCE THRUSTS 15

CONFERENCE RECOMMENDATIONS 21

RESOLUTION ON THE ORGANISATION OF NATIONAL ENVIRONMENTAL CONGRESS 37

THE DELHI DECLARATION ON ENVIRONMENTAL EDUCATION 41

KEY NOTE ADDRESSES 47

MY LESSONS OF ENVIRONMENTAL EDUCATION 49
R. Misra

MAJOR REQUIREMENTS FOR ENVIRONMENTAL EDUCATION 57
Margaret R. Biswas and Asit K. Biswas

SAVE THE SOIL—SAVE THE NATION 69
J.S. Kanwar

AGRICULTURE AND ENVIRONMENT 85
H.K. Jain

STATEMENT ON INTERNATIONAL CONFERENCE ON ENVIRONMENTAL EDUCATION 93
Peter S. Thacher

THE ROLE OF THE MASS MEDIA IN ENVIRONMENTAL EDUCATION 101
H.Y. Sharada Prasad

Page

INTERNATIONAL CONFERENCE ON ENVIRONMENTAL EDUCATION 107
J. Marton-Lefevre

PRESENT STATUS OF EVIRONMENTAL EDUCATION IN THE ASIAN REGION 116
W.D. Ponniah

CONTRIBUTED PAPERS 143

THE PHILOSOPHY AND PRACTICE OF ENVIRONMENTAL EDUCATION IN THE TROPICS: A CRITICAL ASSESSMENT 145
Michael H. Robinson

YOUTH ENVIRONMENTAL EDUCATION AND AWARENESS THROUGH EXTRA UNEP-NGO PROJECT PLANNING 164
Tommy Kwik

THE DEVELOPMENT AND ACTIVITIES ENVIRONMENTAL NGO's IN INDONESIA 169
Bedjo Rahardjo

TEN YEARS AFTER STOCKHOLM SINCE 1972 IN JAPAN 174
Jun Ui

ENVIRONMENTAL EDUCATION IN MALAYSIA A DECADE SINCE STOCKHOLM 178
T. Chelliah

ENVIRONMENTAL EDUCATION IN OMAN 194
Redha Saeed Mohd.

INTRODUCTION OF NUCLEAR POWER IN THE PHILIPPINES A CASE STUDY 200
Sr. M. Aida Velasquez, OSB

REPORT ON ENVIRONMENTAL SITUATION IN SRI LANKA 207
Eardley W. Seneviratne

ENVIRONMENTAL EDUCATION AND RURAL DEVELOPMENT IN THAILAND 225
Kasem Chunkao

Page

AMERICAN ENVIRONMENTAL EDUCATION IN THE AGE OF ACCOUNTABILITY 234
Craig B. Davis and Thomas Tanner

FUNDAMENTALS IN TEACHER PREPARATION AND CURRICULUM DEVELOPMENT FOR ENVIRONMENTAL EDUCATION 245
T. Chelliah

THE ROLE OF RESEARCH AND DEVELOPMENT INSTITUTIONS IN ENVIRONMENTAL EDUCATION 253
S.H.C. de Silva

SACRED AND PROFANE—TOUCHING THE WORLD's BODY: THE ROLE OF THE HUMANITIES IN ENVIRONMENTAL STUDIES 257
Arthur B. Sacks

INVOLVING RURAL CHILDREN IN ENVIRONMENT AND DEVELOPMENT ISSUES: A CASE STUDY FROM KENYA 270
Davinder Lamba and Diana Lee Smith

FOOD OR FUEL 275
Mohamed Kamel

WOMEN AND ENERGY 279
Mohamed Kamel

ANALYSIS AND EVALUATION OF ENVIRONMENTAL EDUCATION IN SOUTHEAST ASIA 283
Desh Bandhu

ENVIRONMENTAL EDUCATION AT THE SCHOOL LEVEL—EMERGING TRENDS IN ENVIRONMENTAL EDUCATION 293
B. Sharan

ROLE OF UNIVERSITIES IN ENVIRONMENTAL EDUCATION 312
D. Shankar Narayan

ROLE OF UNIVERSITIES IN ENVIRONMENTAL EDUCATION AND RESEARCH 319
R. Subramanian

Page

ROLE OF R & D INSTITUTIONS IN ENVIRONMENTAL EDUCATION 324
B.B. Sundaresan

ENVIRONMENTAL EDUCATION FOR PHYSICAL PLANNERS 333
A.J. Contractor and Jitendra Singh

ENVIRONMENTAL MANAGEMENT EDUCATION: AN INDIAN EXPERIENCE 339
N.L. Ramanathan and B. Bowonder

IDENTIFICATION OF PSYCHOLOGICAL, CULTURAL AND PHYSICAL MATERIALS FOR ENVIRONMENT EDUCATION 348
Biswanath Rao

A PROPOSAL FOR MASS EDUCATION OF ENVIRONMENT 355
Rajni Varma and R.R. Das

STRATEGIES FOR USING EXTRA—CURRICULAR ACTIVITIES IN SCIENCE FOR SPREAD OF ENVIRONMENTAL EDUCATION 360
Shakuntala Bhattacharya

GUJARAT'S NATURE EDUCATION PROGRAMME 365
M.A. Rashid

NEWSPAPER'S ROLE IN EDUCATING THE MASS ON ENVIRONMENTAL ISSUES IN INDIA 370
T. Sekar

POPULATION EDUCATION AND ITS RELATIONSHIP WITH ENVIRONMENTAL EDUCATION 380
Sushma Merh

POVERTY AND ENVIRONMENT 390
K.K. Khatu and A.R. D'souza

ENVIRONMENTAL EDUCATION—METAPHYSICS AND INTEGRAL EDUCATION STRATEGY 398
J.S. Rathore

ANALYSIS OF PROBLEMS IN ENVIRONMENTAL EDUCATION 412
Swami Yuktananda

Page

SOME ASPECTS OF MARINE POLLUTION 417
K. Krishnamurthy

TEACHING—LEARNING STRATEGIES FOR ENVIRONMETAL EDUCATION 424
J.S. Gill

SOCIAL FENCING AND INSTITUTIONALISATION OF GREEN GOLD FARMING IN THE HIMALAYAS 433
P.R. Mishra

A STUDY OF ENVIRONMENTAL AWARENESS AMONG CHILDREN OF RURAL AND URBAN SCHOOLS AND NON-FORMAL EDUCATION CENTERS 443
V.P. Gupta, J.S. Grewal and J.S. Rajput

INTEGRATION OF ENVIRONMENTAL EDUCATION INTO THE CURRICULUM OF HIGH SCHOOLS 456
Deep Punia, Ram Kumar Punia and Salilesh Darshan

ENVIRONMENTAL EDUCATION IN TEACHER TRAINING PROGRAMMES 463
M.V. Ramji and A.L.N. Sarma

ENVIRONMENTAL EDUCATION PROGRAMME FOR SCHOOLS A CASE STUDY 474
R.P. Shetye and S.B. Chaphekar

AN EXPERIMENT IN IMPLEMENTATION OF ENVIRONMENTAL APPROACH AT PRIMARY LEVEL 478
J.S. Rajput, A.B. Saxena and V.G. Jadhao

The Conference was Supported by:

Indian National Science Academy/University Grants Commission/Asian Environmental Society/Committee on Science and Technology in Developing Countries (COSTED)/UNESCO-UNEP (International Programme in Environmental Education), C.S.I.R; I.C.A.R; N.C.E.R.T; Planning Commission, Commonwealth Secretariat, Ford Foundation and a number of National, International and United Nations Agencies

Inaugural Address

Dr. B.P. PAL, F.R.S.

Former Chairman

National Committee on Environmental
Planning and Coordination

Hon'ble Minister, Dr. Swaminathan, Dr. Jun Ui, Dr. Desh Bandhu, Dr. Ramanathan, I feel honoured to have been invited to inaugurate this International Conference where so many distinguished participants, both from India and abroad, have gathered to discuss a subject so vital for the conservation and proper care of the Biosphere in which we live and from which we draw sustenance.

The International Conference on Human Environment held at Stockholm in June, 1972 constitutes an important landmark, for on that occasion representatives of the nations of the world met for the first time to give serious consideration to the vital question of how the precious environment could be preserved in order that wise generations of human beings may be enabled to draw from it, vast natural resources, in programmes of sustainable development.

One of the most important areas, in this context, is that of Environmental Education. The Stockholm Conference was followed by one at Belgrade in 1975 when a Charter was drawn up setting forth the goals of environmental action. In the same year, UNESCO and UNDP had launched an International Programme in Environmental Education. Subsequently, an inter-governmental conference specially to consider Enviromental Education was organised at Tbilisi. After that, there have been many conferences at various levels to discuss various aspects and facets of the whole question of enviroment in relation to development, keeping in view the tremendous and rapid growth of the human population and its ever mounting demands.

An excellent summary of the present status of Environmental Education, both national and international, was presented by Dr. D. Shankar Narayan at the last meeting of the Indian Science Congress held at Varanasi in January this year where the focal theme of the Conference was: the Impact of the Development of Science and Technology on Environment. I do not purpose therefore to present any summary of the progress so far made, nor to discuss in detail any of the vast number of issues involved under the title of Environmental Education. These are matters that will be receiving your attention in the course of this Conference. I will merely refer to a few facets only and give you some of my thoughts on these.

The important World Conservation Strategy document released in 1980 states: "Ultimately the behaviour of entire societies towards the biosphere must be transformed if the achievement of conservation objectives is to be assured. A new ethic, embracing plants and animals as well as people, is required for human societies to live in harmony with the natural world on which they depend for survival and wellbeing. The long term task of environmental education is to foster or reinforce attitudes and behaviour compatible with this new ethic." The document further recommends that the organizers of education shall determine the main targets for their programmes and suggests that these groups are:

(a) legislators and administrators;
(b) professional bodies and special interest groups;
(c) communities most affected by conservation projects;
(d) school children and students.

One could of course recognise several more groups, for instance, the general masses of people. I would like to refer to the last category of the four classes mentioned a moment ago, namely, school children and relate a rather charming story I read about a school in America where in teaching biology to young students. the evolution theory had been explained in some details; reference had been made to the tremendous changes in climate this planet of ours had undergone and some animals and plants unable to adapt themselves to sudden and largescale climate alterations had died out. Wishing to reassure herself the lesson had been absorbed, the teacher asked the class, "Now can any one tell me why the dinosaurs became extinct"; A little girl held up her hand and said, "Miss, they were too big to get into Noah's ark". I thought that in some ways it was a bright answer. The young student clearly knew they were very large animals but had related her answer to what she had heard in the Bible class about the Great Deluge! I told you this little tale to emphasise the point that we must begin the process of environmental education with little children when they still are at a stage when they look at the world in wonder, are inquisitive about things and, generally, very impressionable.

When we deal with older children, those going to high schools or colleges, it will be important to link education with practical ongoing programmes because in this category we can hope to find young people fired with imagination and zeal to do things. Here I must refer to a personal experience. Early this month I went to spend an hour at a beautiful chrysanthemum show in the capital. Three teenagers came to me and said they had been shocked and distressed by the way the Delhi Ridge was being encroached upon and the way trees were being destroyed or damaged. They said they recognised that sometimes roads had to be widened or branches of roadside trees lopped to avoid entangled with electric wires, but they were convinced that more trees were being lopped or destroyed than was absolutely necessary because somebody wanted the wood. They explained that they had been to a number of officials but they found they fell into two categories: (i) those who made soothing noises and said "the matter would be looked into", and (ii) those who "passed the buck on". They wanted me to tell them whom they could go to get some positive action. I suggested four names. They said they had already been to two of them, and the third was rarely in Delhi; as for the fourth, they just shook their heads doubtfully. Finally, I suggested a fifth name, that of a retired senior official known for his sympathy for trees and horticulture, and also for his ability to get things done. They thought this was a suggestion worth following up and went away. But I had been moved by their obvious frustration. I also felt sorry I was not able to tell them with some measure of confidence as to where they could urgent, responsive action.

The Delhi Ridge to which I have just made reference is a continuation at a lower level of the Aravalli hills of Rajasthan and plays an important role in moderating the climate of Delhi, acting as a windbreak and providing a large "green lung" for the rapidly expanding metropolis. The National Committee on Environmental Planning and Coordination (NCEPC) at a meeting which I had the privilege of chairing, recommended that the metropolis of India itself should set a good example of conservation of a valuable natural resource which has suffered considerable erosion because of the building of schools and other buildings in spite of a decision at the highest level that no encroachment should be permitted.

Since we now have in the Government of India a new department *i.e.* Department of Environment specially charged with preservation of the environment and the dynamic Minister in charge of that department is here with us this morning, I feel we may look forward to urgent steps being taken to assess the present status of the ridge and to arrange for regular monitoring and other action to save this precious asset of the capital of India. I may mention in passing that the NCEPC further recommended strongly that the present natural character of the vegetation on the ridge should be conserved and that people should not be allowed to meddle with it in the name of so-called beautification. Delhi, like Rome, is one of the Eternal Cities and deserves special attention to preserve its natural assets and traditional attributes.

One may ask, who are these people who go on nibbling at the ridge and gradually destroying it are they ignorant of the need for conservation, or just insensitive to it? In either case it reflects a failure of our system of general education. It is essential that apart from special courses in evironmental matters for those who need it, a consciousness and awareness of the natural environment and the value of plants and animals, should thoroughly permeate the whole educational system. It is usual to distinguish between education which aims at establishing sensitivity to environmental problems from training which has as its objective the developing and mastering of skills for solving environmental problems and refers to specialised action. The two instances I have cited refer of course to the former category. In this would fall the large majority of the population, the greater portion of which lives in rural areas. People in rural areas are usually closer to nature and do not wantonly destroy or damage natural resources. If such people do destroy trees, it is to satisfy some of their basic needs. Social forestry to which much lip service has been done is still something which has not materialised, in most of the areas. It is a very sad sight to see women of the under-privileged classes in the hills and elsewhere who have no other source of fuel to cook their food, trudging over long distances every day to collect a bundle of sticks. Before preaching the gospel of conservation to such classes of people, it is necessary first to provide the basic necessities of life. The largest amount of damage in fact has been done by industry and trades which take away large quantities of timber without having ensured that fresh plantations of trees are made to keep the resource going.

Apart from education to create awareness for conserving soil, water and living resources, and for preventing pollution, many types of courses are needed to cater to the many and pressing requirements of trained personnel to ensure that the quality of the environment is maintained at the optimum level. In some cases, specialised cadres may need re-orientation. For instance many foresters have been trained in production forestry to get the maximum returns from the forest but have not been made aware of the remarkable ecological role played by the forested areas. Engineers who plan and build dams and large irrigation works obviously need to be introduced to the concept and practice of environmental conservation.

There is also a vital need for suitable books to support the many kinds and levels of environmental education and training programmes that are necessary for ensuring an effective and enlightened handling of environmental problems. Here, I would like to digress a little and refer to the splended achievement of the World Wildlife Fund in creating awareness about the serious threat to wild life, leading to the extinction or near-extinction of many species. This organisation has however concentrated mainly on some of the larger animals and certain birds. Some of the smaller and less glamorous types are also in danger of being lost. Then there is the whole world of plants so important, for instance, for the development and improvement of agriculture and medicine. Somehow they have attracted less of the limelight than animals who would not be able survive in the absence of plant life. Even the Bible story of the Great Flood and Noah's Ark does not, as far as I remember, mention whether Noah took any steps to save the plant species after he had put in a male and female pair of each of the animal species, excepting of course the dinosaurs referred in the story of the school girl! It is necessary that environmental education should disseminate a feeling for the wonder of the Creation, the complexity of the web of life and the inter-relationships between animals, plants and lower organisms, and finally, how man's own survival depends on his being able to live in harmony with nature.

I feel that conservation of the environment should be interpreted in the broadest sense and should include cultural heritage which also is endangered in many ways. We should preserve, undamaged as far as possible, the precious monuments and works of art. We should also conserve areas of great scenic beauty which inspire in man the highest and purest of feeling.

I now come to the concluding portion of my address. I hope that the papers presented will prove informative and fully relevant, and lead to lively discussion. I further trust that clear recommendations will emerge on the policies and programmes which should be followed subject of course to modifications appropriate for the conditions prevailing in each country. I would like to repeat a story which I once told to a conference of scientists in Delhi. This recalls that towards the conclusion of an international conference in which many very eminent persons had participated, the chairman said: "I hope this will not be like the marriage of elephants where everything takes place at a high level, there is a lot of trumpeting, and then nothing happens for about two years". I feel sure that with an Organising Committee headed by Dr. M.S. Swaminathan, this Conference will not end up with the repetition of well-known platitudes but the discussions by the distinguished delegates will present us with clear recommendations which will enable a clear step forward to be made.

Distinguished Minister, ladies and gentlemen, I offer my best wishes for the success of the Conference which I have very great pleasure in inaugurating.

President's Address

Shri C.P.N. SINGH

Minister of State for Environment
Government of India

Dr. Pal, Dr. Swaminathan, distinguished delegates and friends,

It is an honour to participate in this function which makes the beginning of the International conference on Environmental Education. The size and diversity of the gathering is an indication both of the subject matter and the importance attached thereto. We have had large international conferences on the subject in recent years and it will be necessary for the deliberations here to augment the knowledge and insights gained earlier at Belgrade, Tbilisi and other places.

We in India have benefited from the experience of other nations and international bodies in the field of environmental protection and education. However, the problem we encounter in our context are quantitatively different from those of many other countries and vary widely from one part of this huge country to another. This is obvious when one realises that we have in India the Himalayan eco-system, the Indo-Gangetic plains, the tropical rain forests as well as hot deserts, besides a varied array of intermediary eco-systems. Therefore, the tools and techniques for environmental education will have to be adapted to suit these sharply varying conditions which they must address. Equally varied is the diversity of our people who form the target audience for environmental education. The point is that simple, catch-all approaches to education based on inadequate knowledge of widely varying local conditions will not be of much use.

The protection of environment is a matter of national concern to us. It is reflected in the Directive Principles of State Policy of our Consitution. Recognising the need for a major coordinating body on environment-related action, the Government of India last year set up a full-fledged Department of Environment. An environmental forum of parliamantarians has also been constituted to focus attention on environmental issues At the formel levels we have courses in environmental education at a number of institutions of higher learning in the country. Useful research in environmental sciences is being supported by the Department of Environment, the University Grants Commission and other funding bodies. But at a more practical level, it is clear whether adequate employment opportunities have been created for our young people who opt for this field. Such people should not be put to the double disadvantage of unemployment in their area of specialisation on one hand and on the other not being considered for employment where qualifications in the traditional disciplines are required. Perhaps the Government needs closer look at this aspect of coordinating the supply for expertise in this field with creation of demand for it. I am sure this meeting will have a chance to deliberate on this problem. More exciting work in environmental education and training is going on at the non-formal level in India. It is heartening to see a large number of voluntary agencies involved in this field with some of them supported by the Department of Environment. The Sixth Year Plan gives explicit recognition to the role of Non-Government Organisations in environmental protection. One of the more intersting programmes is the organisation of what are called 'Eco-development Camps'. Young people from our academic institutions, in partnership with experienced professional and local citizens, take on the job of reclaiming or renewing environmentally degraded areas through measures like soil-protection, afforestation, etc. While this directly benefits the people of the area through regeneration of natural resources on which they depend, it also provides our youth an excellent opportunity to gain practical and first-hand knowledge of the problems of the environment and ways in which they can be tackled. These camps are being organised through the National Service Scheme and with the efforts of various voluntary groups. The eco-development camps could prove to be a major force in checking environmental degradation.

There is a lesson to be learnt here. Many programmes of environmental education aimed at those who, through force of circumstances, have to exploit natural resources in an environmentally unsound manner, do not provide reasonable or feasible alternatives to meet basic human needs. For instance, it is pointless to ask a poor man up in the himalayan highlands to stop cutting trees for firewood if he has no other meens to cook food and keep himself and his family warm. We all realise this, but continue to develop educational programmes which publicise impractical and ill-thought approaches.

An important long-term solution to these lop-sided policies is proper education of our planners and decision makers. I understand the

Department of Environment is organising training workshops on environmental management with the help of the Administrative Staff College of India. Such short term courses ought to be made mandatory for all our civil servants and technocrats, who sometimes are equally short-sighted. What is not often realised by such people is that environmental considerations must pervade and influence decision making in every sector of out economic, social and cultural life. Environmental management is a total, intergrated approach to sustainable national development and not a separate subject which is the sole concern of the Department of Environment or some voluntary agencies and associations. This is the basic message which environmental educational must seek to propagate.

The Government of India's commitment to environment protection and education is total. Our Honourable Prime Minister has used national and international forums to give a proper perspective and orientation to environmental debates and action in the context of developing countries like India. She has highlighted our age-old roots in environmentally sound ways of living by quoting our scriptures. Environmentalists all over the country have in the past drawn strength from her strong support to this cause. We still have a long and difficult path to traverse before we can say that we have successfully reversed the process of environmental damage.

Hence, we have to face the challenge of educating our society of the dangers and more importantly, the tremendous potential for personal and national fulfilment that follows from a prudent and far-sighted use of God-given natural resources. I hope this Conference will lead to a more fruitful expression of our shared concern.

Synopsis of the Conference Thrusts

Being fully conscious of the impending global crisis posed by creeping enivronmental degradation and ecological disruption, the delegates to the International Conference on Environmental Education, New Delhi, 16-20 December 1981, expressed utmost concern and urged governmental and public collaboration in initiating and executing enviromental impovement and ecological restoration programmes. The delegates recognised the urgent need to awaken the environmental conscience of politicians, opinion leaders and statesman, bureaucrats, technocrats, policy planners and decision makers, in the governments, and men, women and children in all walks of life. The delegates advocated that a new and forceful thrust be given to environmental education and awareness programmes in both the formal educational systems at the preschool, school and university levels and in the nonformal public information media for this purpose. For, only by this means can the public be motivated to actively participate in environmental improvement projects at the local, regional and national levels. The delegates were convinced that a rational plan to limit population growth, to utilize wisely available resources, and to choose only development strategies consonant with environmental protection must be drawn up so that human progress can proceed in a sustainable manner in future. The Conference concluded that human progress and environmental protection can and must reinforce each other. Development without destruction is not only possible, but economic development with concurrent environmental enhancement should be our endeavour, for one without the other would tarnish the quality of human life on earth.

The Conference discussed wide ranging topics relevant to environmental education, training, orientation, awareness and research and made several recommendations for specific consideration by appropriate implementation by the governments, public bodies, educational authorities, the mass media, writers, authors, playwrights and non-governmental organisations. The papers presented in VIII sessions focussed on the status and strategy of environmental education, on methodology of incorporating environmental issues in the curricula for formal education of pupils and professionals, on the role of the media in broadcasting environmental concerns, on the experience of various groups in India and other countries in the field of environmental education and on action plans for promoting environmental education at all levels.

The International Conferenee on Environmental Education raised many important issues of both immediate and long-term nature, and local, regional and international significance. While the conference concluded that the model to be adopted may and must vary from country to country and even from region to region of the same country and must be tailored to fit the language and literacy, the social values and mores, the customs and beliefs, and the lifestyle and aspirations of the people, it was felt that some general principles and strategies could be enunciated.

There was an attempt to define "Environmental Education" and to distinguish formal instruction in the classroom both for inculcating general knowledge and for developing specialised skills from the extra-curricular programmes for children and from the non-formal system for all people using a variety of public information media. The Conference, however, without defining the meaning and scope of Environmental Education, arrived at a consensus that it should:

* View the environment in its totality; thus the environment would include both the natural and man-made systems and embrace the technological, socio-economic, cultural, moral, aesthetic and political aspects, where appropriate;
* Adopt an inter-disciplinary approach, drawing on the specific concepts of each discipline;
* Form a continuous cradle-to-grave process beginning at the pre-school stage;
* Deal explicity with current and potential environmental scenarios, taking into account the historical experience in the same or other countries, and the background of the development process and status of the country;
* Examine illustrative environmental issues at the local, national, regional and international levels, so that geographical insights and global perspectives can be achieved;
* Inculcate that environmental problems are the people's collective concern;

- Promote environmental sensitivity and knowledge;
- Develop a problem-solving attitude;
- Encourage local, national and international cooperation for the prevention and solution of man-made environmental degradation and ecological disruption;
- Introduce the culture of examining the environmental impacts of development alternatives; and
- Enable environmentally-compatible and ecologically-desirable decisions by the individual and the nation.

It was also emphasized that people (men, women and children) should not only be receipients of environmental orientation but also be transmitters of such knowledge to others. Environmental education programme should touch off a chain reaction. It was particularly emphasised that environmental orientation programme must be initiated immediately for women, especially rural women.

The Conference benefited by the addresses presented by eminent educationists and environmental specialists, who highlighted the different aspects of environmental education, in the first session on significance and importance of environmental Education. These keynote address covered the following themes:

1.	Significance of Environmental Education	Dr. (Mrs) Madhuri R. Shah Chairman, University Grants Commission, New Delhi.
2.	Major Requirements for Environmental Educations	Dr. Margaret Biswas and Dr. Asit K. Biswas International Water Resources Association, U.K.
3.	My Lessons of Environmental Education	Prof. R. Misra Banaras Hindu University, Varanasi.
4.	Statement on behalf of IUCN on Environmental Education	Mrs. Julia Martin Lepeure Commission on Education, IUCN.

The following special lectures also evoked allround interest.

1.	Agriculture and Environment	Dr. H.K. Jain, Director, Indian Agricultural Research Institute, New Delhi.

2.	UNEP Programme in Environmental Education	Dr. Peter Thatcher, Deputy Executive Director UNEP, Nairobi.
3.	The Role of Mass Media in Environmental Education	Shri Y. Shara Prasad Information Adviser to the Prime Minister, New Delhi.
4.	Infoterra—UNEP Information system.	Dr. Asok Khosla Director, Infoterra, UNEP, Nairobi.
5.	Save the Soil—Save the Nation	Dr. J.S. Kanwar Director, Research ICRISAT, Hyderabad.

Conference Recommendations

This synthesis is a collection of the various recommendation which arose during the discussions in the different sessions and many write-in recommendations and suggestions from the participants, who were invited by the Chairman of the Conference to do so. An attempt has been made to categorise these recommendations, in spite of the overlap of some of these and the commonality among different categories. Care has been taken to include even the obvious recommendations, in order to achieve comprehensiveness. Apart from specific suggestions which could be categorised, there were a host of thoughtful recommendations which could only be categorised as 'General'. Since most of these were important and concerned with basic strategy for environmental education, it is appropriate to start with this category and end up with the intimate interface between population education and environmental education.

I. GENERAL RECOMMENDATIONS

1. Environmental education programmes in most countries has yet to become fully established and therefore, governments should be urged to emphasise environmental issues in the educational scheme.

2. It was pointed out that deeper understanding of the environment prevailed in the vedic period and that Mahatma Gandhi had included this concept in the basic education scheme. A review of the strategies for creating environmental awareness in the past could give an insight into the approaches necessary in the future.

3. Environmental action needs as pre-requisite, committment at the individual and national level. A clear national policy on environment is thus essential and without this, curriculum development for environmental education would lack direction and purpose.

4. The main hurdle at present appears to be teacher training in

environmental education. Appropriate teacher training programmes and materials for their use must be started without delay in order to implement environmental education programmes in schools.

5. To be meaningful, environmental education must relate to real-world situations and should be linked to current development plans.

6. The multi-disciplinary nature of environmental studies must be recognised and accepted.

7. Further, in view of the influence of the culture, beliefs and literacy of the people on their attitude to the local environment, environmental instruction must integrate cultural, social and development needs and appropriate technologies for development.

8. All sections of human society must be exposed to some form and measure of environmental education for arousing their awareness, sensitivity and perception of environmental problems and thereby motivate them to get involved in worthwhile environmental action programmes.

9. Fundamental issues in the process of studying the environment as systems could be related to one or other specific academic discipline. On the other hand, location-specific, and comprehensive programmes with environment as a single system, are needed to stimulate enlightened decision-making and community action.

10. Environmental education is a long term process beginning at the infant stage and continuing through formal preschool, school, college and university stages and thereafter through nonformal means throughout adult life.

11. Value orientation in environmental education has to be a world movement.

12. Environmental education must be relevant to the immediate environment of the learner in order to be useful and meaningful to him/her.

13. Environmental education policy must conform to other related policies on population regulation, human settlement, land and water, conservation and development.

14. Special attention should be given to environmental education

focussed on non-school going children, adolescents and women.

15. Environmental education is and has to be an integral part of all education programmes and also should become part of social, cultural, and economic development education.

16. It mught be useful to modernise inbuilt religious concepts, relevant to environment and conservation, such as those inherent in *vedas and smrutis*, *puranas*, classical works, Bible, Koran and Torah, and the messages of Buddha, Asoka, Kautilya, Manu, Mahatma Gandhi and so on and incorporate these in the early education of infants, using the technique of story telling in the grandma's laps.

17. Every country and community should develop and implement a master plan for environmental education. The plan should lead to the evolution of an ecological ethos, that is, a change of the present callous atiitude of man towards man, nature, and society.

18. Environmental Education should enable people to perceive the environmental in its totality, that is, the totality of physical, biological, socio-economic and cultural complex it is.

19. Clean environment must be made a fundamental right of all citizens.

20. Environmental education must be aim at enlisting the cooperation and involvement of the people in environmental action.

21. Environmental Impact assessment and its usefulness in anticipatory prevention of environmental abuse should be communicated to everyone.

II RECOMMENDATIONS ON FORMAL EDUCATION NEEDS

A. School Level.

1. There is an urgent need for textbooks and teaching aids for environmental education programmes at all levels. Authoritative books on environmental protection as well as materials such as case studies, photographs, charts, maps, slides, films and other audio-visual aids on environmental problems are necessary. Encouragement and financial assistance to scientists may be given for preparing such materials.

2. Environmental education at school and under graduate levels should aim at creating environmental awareness. At higher levels, the objective should be to develop basic knowledge and skills for tackling and solving environmental problems.

3. Environmental concepts should be integrated in existing courses in physical, natural and social sciences.

4. Students should be exposed to the concept of nature education and the experience of participating in nature conservation programmes, similar to the social forestry programme in Gujarat.

5. Various educational bodies should reorient early education curricula to include environmental issues.

6. Extra carricular environmental programmes for school children are a power ful tool for imparting environmental education to children and should be increasingly encouraged. Such programme should incorporate four elements, namely, adventure, learning, grassroots action and links with both environmental offenders and beneficiaries. Results of such an approach, as illustrated by case studies presented by Mazangira Institute in Kenya and Socleen in Bombay show that environmental awareness of children become not only sharply focussed but eventually leads to successful teaching at the school level also.

7. Several techniques for providing extra curricular environmental education to school children are available. These include sending out by mail or distributing in the class room entertraining children's magazines on environment, organisation of nature and science clubs, visits to exhibitions and museums, organising painting and essay competitions and exhibitions, participation in community environmental action programmes and using songs, plays, folk tales, puppet shows and environmental games and puzzles.

8. At the higher school level, it would be more purposeful to involve youth in seeking and finding solutions to environmental problems and thus inculcate a positive environmental attitude.

9. Correspondence courses in environmental education for elementary and secondary school teachers should be initiated by teacher training institutions like NCERT.

10. Environmental magazines for the use of and by teachers should be brought out.

11. Periodical Workshops and seminars on environmental topics should be arranged for teachers, by organisations like the Indian Environmental Society.

12. Besides textbooks, other kinds of teaching aids for environmental education such as guides, handbooks, slide shows, films, models etc should be developed.

13. Parent-Teacher Associations should discuss environmental education strategies critically and evolve appropriate school-home integration for infusing the right attitude to environment in the children.

14. Programme suited for non-school going and drop out children should also be developed.

B. University Level

1. Universities should provide training for graduates, who can assimilate a comprehensive view of the environment and its problems.

2. All graduate courses should allocate a minimal period for class room instruction, discussion or other suitable presentation of environmental topics.

3. At the university level also, it is best to integrate environmental topics into the various subjects streams such as physical, biological, social and economic sciences and in humanities.

4. University Grants Commission or other equivalent body should draw up the syllabi for various disciplines and induce their adoption.

5. Malayasian experience of post graduate diploma courses for teachers has shown that environmental awaraness could be developed through discussion of real-world environmental problems, that skills to identify, analyse and present environmental problems and solutions could be imparted and that development of packages on environmental topics is feasible.

6. Carefully drawn syllabi for environmental training of teachers at the diploma, degree and post graduate levels are urgently needed. These should include ecology, environmental economics, cultural perspectives, causes of pollution and their control, resource manage-

ment, population links and responsibility of man towards the environment.

7. Environmental law should be taught in all law colleges and facilities for specialisation in environmental law should be provided.

8. Graduate and postgradute programmes in environmental management should be started at several centres.

C. **Research**

1. Environmental Research should focus on issues of national concern and lead to strategies of containment and solution and thus help decision makers.

2. Environmental diemensions may be built into existing research projects.

3. An Institute of Environmental Management should be established for undertaking advanced multi-disciplinary research in environmental subjects, for imparting high level training for decision makers, planners, environmental managers and for offering high quality consultancy in environmental technology.

4. An Indian Council of Environmental Research and Training (ICERT) should be set up by the Department of Environment.

D. **Curriculum Development**

1. Regional and national colleges of education and similar institutions should immediately undertake the preparation of suitable curricula, teaching materials and books for environmental education at the school level.

2. The case study method is a valuable tool for environmental training of high school and university students and in post graduate and specialised courses. There is urgent need to create an authentic body of knowledge and information-base for environmental education and these may be generated through case studies.

3. More emphasis should be given to the methodology and evaluation in environmental education programmes.

4. In planning environmental education curricula, due considera-

tion and persvective should be given to population growth, resource depletion, conspicuous consumption, pollution generation, lack of civic consciousness, and such other relevant issues.

5. A compendium of information relevant to environmental education, including a directory of sources of information about urban and rural resources and institutions, and listing of persons with appropriate expertise should be prepared and made widely available.

III. NON FORMAL EDUCATION

A. General

1. Environmental information must be dissemenated at all levels of the population, since in the ultimate analysis, only an environmentally conscious public can save the world from an environmental crisis.

2. Non-formal environmental education undertaken by governmental and non-governmental organisations, including youth organisations should be encouraged and supported by the Department of Environment.

3. Centres for non-formal environmental education Paryavaran Kendras must be established in urban and rural areas, especially in places where environmental degradation is beginning to set in.

4. The public should be made aware about the harmful consequences of human pressure on ecosystems (lakes, sanctuaries, hill areas etc), and particularly about the impact of tourism in such resorts.

5. In the Himalayan region, people have to be made aware of overgrazing by cattle, overexploitation of forests and unplanned development of roads, tourism and industries.

B. Training

1. Decision makers must be provided orientation training in environmental management.

2, The courses in management, namely business and engineering, should be reoriented to include topics on environmental management.

3. Courses on environmental management similar to the one

sponsored by the Department of Environment at the Staff College, should be started at other centres for training a large majority of administrators, policy makers and other target groups.

4. Training imparted should be based on local and regional problems and should also be need oriented.

5. For greater awareness and real learning, education should be based on environmental problems experienced by people.

6. Awareness of the industrialists about the potential harmful effects of their activities on the environment must be created and their sense of social responsibility awakened.

7. The public should be made aware of the increasing levels of food contamination in the country, especially by toxic chemicals.

8. Training programmes for Central and State services should incorporate environmental topics.

9. A series of refresher courses for planners, teachers decision-makers, political leaders and even ministers should be organised.

10. Nonformal environmental education should be integrated with programmes like family planning drives etc and should from part of the work of voluntary organisations in rural areas.

11. Environmental education should be included in the probation training of administrative, and other services, management trainees of companies, gram panchayat and block development officials, and such groups.

12. Environmental topics should be included in competitive examinations held by Public Service Commissions, Agricultural Recruitment Board, Banking Recruitment Boards, Armed Services Board, and etc.

13. Professional groups like teachers, doctors, engineers, planners and social scientists should be given refesher training in environmental issues.

14. Volunteers from non-governmental organisations should be trained in environmental education in order to equip them to carry out their work on correct lines.

15. Environmental education should be imparted through adult education programmes and organisations of youth like NSS and NCC may be made use of for this purpose.

16. In view of the close-relation between population growth and environmental damage, population education and environmental education programmes should be integrated and offered concurrently.

17. Special programmes and drives to make women aware of environmental issues and solutions should be undertaken, so that they, in their turn, may inculcate their children.

18. All educational institutions should be mobilised to undertake some kind of nonformal education, including environmental education.

C. Mass Media

1. Mass Communication media was recognised as a powerful and effective tool for spreading information about the environment.

2. Media personnel should be trained to become proficient in spreading environmental consciousness.

3. Mass Media, Press, Radio and TV, should develop and employ environmental education professionals.

4. Mass Communication techniques appropriate to the conditions of the target audience should be developed.

5. Traditional techniques of information dissemenation like folk plays, puppet shows, balladiers, etc should be used for environmental education.

6. Painting and essay competitions on environmentat topics should be organised nationally.

7. Posters depicting environmental situations should be produced and exhibited widely.

8. Travelling environmental exhibitions mounted on bullock carts, camel carts or vans should constantly and periodically tour through the rural areas.

9. Short, illustrated pamphlets, booklets, brochures on environ-

meut should be prepared by professionals and widely distributed.

10. Long distance rail passengers may be provided on entering the compartment, a booklet describing the ecosystem components and impact caused on them by human and animal pressure, along the route.

11. An attractive environmental information folder may be given to every tourist arriving in the country.

12. A Gandhian style mass movement or satyagraha for environmental protection may be started.

13. Stories, cartoons and playlets on environmental issues, should be produced.

14. Feature films dealing with environmental protection may be supported by the Films Finance Corporation.

15. Documentaries dealing with environmental questions of local, regional, national importance should be produced for exhibition through the cinema circuit.

16. All popular environmental materials. (books, periodicals, handouts, exhibits, films, posters etc) must be simultaneously produced in all the official languages in India.

17. Representatives of the people should be fed with suitable environmental literature.

D. Role of NGOs

1. A Directory of Governmental and Non-governmental organisations in the field of environment should be prepared.

2. All NGOs should include environmental education in their package of activities.

3. NGOs should catalyse public involvement in environmental programmes.

4. NGOs have a vital note to play in creating environmental awareness at all levels.

5. NGOs should begin a decade of consumer and environmental

education and involve youth organisations in their work.

6. NGOs should harmonise their activities with government bodies.

7. NGOs can and should undertake environment-based adult education.

8. The Department of Environment should provide a nodal point for NGO activities and act as a clearing house for information on NGO work in environmental education, action and programmes.

9. A newsletter of NGO efforts in the environmeatal field should be published.

III. STARTEGIES AT NATIONAL, REGIONAL AND INTERNATIONAL LEVELS

1. Training programmes in environmental management should be set up at the regional level by regional organisations and national governments.

2. Environmental considerations should be integrated into economic development plans at the national, regional and international levels.

3. Regional and international cooperation in and information exchange on environmental education should be fostered by UN agencies like UNEP, UNESCO, UNDP and regional organisation like SACEP, ASEP, SPREP etc.

4. Transfer of technology in environmental education, management and action between developed and developing countries and between developing countries should freely promoted.

IV. ACTION PLANS

1. A wide range of environmental education materials for different sections of society must be produced urgently. The Department of Environment should support this endeavour.

2. Research in appropriate technology for enveronmental education should be promoted.

3. Problem solving and action oriented case studies on environ-

mental issues of local significance should be taken up and instructional materials based on these prepared.

4. Surveys of present attitude of people towards the evironment should be carried out to serve as baseline index to gauge the impact of environmental education.

5. Pedagogic methodology for environmental education must be envolved in a scientific manner.

6. Curricula in environmental education suitable for different levels from preschool to university have to be developed, simultaneously with production of required text books, additional reading materials and audio visual aids.

7. Mass Media should produce professional material on environment for wide dissemination among the public.

8. NGOs should chalk out a national compaign for creating environmental awareness for target groups, with built-in periodical review and evaluation.

9. A information exchange network on environmeltal education should be set up at the national level.

10. A newsletter, or newsmagazine exclusively for environment should be brought out.

11. Every news daily and magazine should regularly carry articles of environmental interest written by professionals and trained journalists.

12. Social welfare departments must integrate environmental concerns in their programmes.

13. Health authorities should give priority to environmental health. They should prepare plans and schemes for preventive measures against environmental maladies and implement them conscientiously. They should also undertake environmental health education.

14. Persons with well developed environmental consciousness should be preferred in recruitment at all levels.

15. A National Committee or Board on Environmental Education should be set up by the Department of environment to promote environmental education programmes, to review progress and evolve required policy at the national level, giving due consideration to the recommendations of this conference.

16. The Department of Environment in conjunction with the Ministry of Education, should convene a meeting of Ministers of Education in the states, along with Secretaries of the Education Department and Directors of Education for adoption of a programme of environmental education in the schools.

17. NGOs should band together in implementing a coordinated environmental awareness compaign.

18. Mass Media should mobilise itself for a comprehensive environmental perception programme in a mutually reinforcing manner, using all media from TV to folk plays.

19. Information packs on environmental themes should be brought in different languages by NGOs with help from the Department of Environment.

20. A nationwide reorientation programme in environment for educators, teachers and other professionals should be started.

21. Appropriate training programmes in environmental management for target groups should be started by Department of Environment in association training institutions, universities, school systems, staff training centres, management institutes etc.

22. Teacher-training in environment should be stepped up by all teacher training centres.

23. Environmental awareness programmes for women should be started urgently.

24. Regional and international cooperative activities in environmental education, including speedy information transfer, should be given priority by UN and multilateral agencies.

25. The report and recommendations of the International Conference of Environmental Education should published without delay and widely distributed to governments, concerned government departments

and non governmental organizations in order to enable then to identify follow up areas of their interest and concern and implement the recommendations.

26. Education programmes in environment should be enmeshed with the population control movement and family planning education.

Resolution on the Organisation of National Environmental Congress

The following resolution was adopted unanimously by the delegates to the International Conference on Environmental Education, 16-20 December 1981, New Delhi.

"The delegates to the International Conference on Environmental Education, discussed a proposal received from Prof. C. Karunakaran, Director, Centre for Earth Science Studies, Trivandrum, concerning the organisation of a National Environmental Congress. After detailed discussion, the Conference recommends that an Indian Environmental Congress Association may be set up in 1982. The design of the Congress may be on the following lines:

(i) The Congress may be organised once in two years at a suitable location, particularly in an area of the country, where serious environmental problems prevail. In the year preceding to the National Congress, Regional/State/Local Level Seminars/Symposia/Workshops may be organised by affiliated environmental societies. The Local Level Seminars may be held in the language of the region, as far as practicable. The major points emerging from the Local Level Seminars will be collated and presented at the National Congress.

(ii) In order to organise this Congress at periodic intervals and to carry out other activities, such as the organisation of exhibitions and publication of bulletins, proceedings and newsletters, an Indian Environment Congress Association may be established. The membership of the Association should be open not only to individuals but also to professional bodies and institutions, District Rural Development Agencies, Scheduled Castes and Scheduled Tribes Corporations and Associations, mass education organisation like Kerala Sastra Sahitya Parishad, etc. The Association will function as a national consortium of all organisations and individuals interested and actively participating in environmental programmes. It could have as Associate Members similar societies in other countries, as for example the Asian Environmental Society, National Association for Environmental Education of the United States, etc.

(iii) *Government Support*: The Society should have appropriate linkages with the Department of Environment of the Government of India, which should be the nodal Department of Government dealing with all matters connected with the organisation of the Indian Environmental Congress. The Department of Environment may provide necessary grants to establish the Association, its permanent office, for organising meetings, Congress and for bringing out publications.

(iv) *Programme for the Congress*: Each National Congress should have a focal theme of relevance to the conservation and scientific utilisation of environmental assets. The focal theme should provide opportunities for an inter-disciplinary examination of the problem and to offer concrete suggestions, recommendations and action plans, for the consideration of State and Central Governments. The focal theme for the first Congress could be the "The State of Environment in India". In addition to the focal theme of discussion, there could be sectional examination of important topics, such as population pressures, pollution abatement, environmentally compatible development alternatives, endangered eco-systems, human settlements and habitat, mountain and ocean eco-systems, etc. The programme of the Congress should be structured in such way that discussions can be promoted on problem-solving lines, as far as feasible.

(v) *Inauguration*; The Association may invite the Prime Minister of India to inaugurate the Congress;

Follow up: The Congress recommends that in order to develop this proposal further and get the Indian Environmental Congress Association organised and registered, a follow up committee under the Chairmanship of Dr. M.S. Swaminathan may be constituted by the Department of Environment, which would provide the secretariat support. This committee should complete its work speedily so that the Association can come into existence as soon as possible.

These recommendations may also be communicated to be delegates of the Indian Science Congress during the forthcoming Session in Mysore from January 3-8, 1982."

The Delhi Declaration on Environmental Education

Adopted unanimously by the Delegates at the International Conference on Environmental Education, 16-20 December 1981 New Delhi.

The International conference on Environmental Education organised in New Delhi, India, from 16th to 20th December, 1981, by the Indian Environmental Society and the Department of Environment of the Government of India, with the active support from and participation of a number of other governmental and non-governmental agencies, including the agencies of the U.N. family, and representatives from several countries, on the basis of the deliberations of the Conference. taking into account:

(a) the present stage Environmental Education has reached, as a result of the national and international efforts since the Stockholm Conference of 1972, followed by the Belgrade Charter of 1975 and the inter-governmental conference at Tbilsi in 1977.

(b) the principles, methodologies and approaches being developed to promote Environmental Education at all levels of education, for all groups and citizens of all ages, through both formal and non-formal processes of education.

(c) the awareness to environmental problems of local and regional relevance promoted by the voluntary agencies, professional societies and non-governmental organisations for initiating appropriate remedial action programmes.

(d) the solemn declarations of national governments in adapting and enacting appropriate policies for expeditiously developing environmentally conscious actions in the context of various developmental programmes,

(e) the vast variety and extent of reliable and useful information generated by specific case studies on emerging environmental problem areas,

(f) the nature of teaching, training, research and extension programmes being currently strengthened in the school and university systems and in the R & D institutions, and

(g) the state of the world environment as surveyed by the U.N. Environment Program,

calls upon everyone concerned, individuals, groups, communities, national governments and national and international voluntary agencies to promote the cause of environmentally acceptable and sustainable development through all round environmental education campaigns and appropriate action plans.

2. The Conference draws particular attention to the fact that the goals of the U.N. development decades as well as the new international economic order cannot be realised without an accelerated pace of economic progress in developing countries. In order to achieve harmony between short and long term goals of development, countries will have to acquire the capacity to foster development without disruption of the ecological assets. Development paths must be chosen so that the environment is not degraged, its resources depleted, or ecological balance disturbed. This calls for a massive programme of environmental education, research and monitoring. The exploding population, the mounting consumption of the earth's resources, unwise and incompatible development goals, the uncertainty of prevailing peace all over the world, the shrinking forests and arable land, the marching deserts, the 'greed of the rich and the need of the poor',—all these place an impossible stress on the environment. At this rate of development, man and all living systems may run through the available resources for existence in a short time. Two well realised facts are sufficient to understore the environmental crisis.

(1) While half the world and two-thirds of the human population is reeling under the lack of basic minimum needs for survival, the rest of the world indulges in thoughtless, wasteful consumption of all resources like food, energy, and other renewable and non-renewable consumables. A more equitable distribution and utilization of such resources, as envisaged in the new international economic order, is the means to ensure environmental conservation. For, it would rule out wasteful over-consumption on the one hand and it would erase the environmental problems caused by underdevelopment.

(2) The sense of insecurity among world powers with the consequent compulsion to be prepared for all eventualities is another factor contributing to our present environmental concerns.

The obsession with weapons and military soultions to global problems has pushed arms budgets to US $550 billion a year. About US $100 billion of this outlay goes to the growing stockpile of nuclear weapons, which already is over one million times the explosive force of the Hiroshima bomb. Civilian productivity lags but military productivity is up smartly. The World War II submarine could sink only passing ships; now a single sub can destory 160 cities as far away as 4,000 miles. World military expenditures equal the annual income of the poorest half of the world's population.

3. The Conference fully supports the following views conveyed by the Prime Minister of India, Smt. Indira Gandhi, to the Conference participants through several of the participants who called on her on 18th December, 1981:

(a) Poor people live close to the earth. They will support and participate in environmental programmes only when they are convinced that the programmes would benefit them. Therefore, legislation alone is not adequate for achieving conservation goals. Legislation must be backed up by people's action, which can be generated only when people can see tangible economic benefits from conservation programmes.

(b) A reasonable chance of survival of children is essential for the acceptance of family planning methods.

(c) Both total disarmament as well as nuclear disarmament is essential to promote harmony and happiness among human beings.

(d) Environmental education should start from childhood so that the child becomes fully aware of the inter-dependence of the different components of the earth.

(e) Environmental education should be both through formal curricular methods in school and universities and through continuing education with the assistance of mass media.

(g) Those engaged in environmental education should help to arouse social consciousness and make the community aware of the fact that the good of the individual and that of the community are both harmed by ecological disruption.

4. The demographic composition of developing countries is such that a majority of the population belong to the younger age groups. The International Youth Year 1984, therefore, should be utilised effectively for environmentally desirable programmes such as tree planning, soil and water conservation, establishment of national parks and bio-sphere reserves and the restoration of damaged eco-systems.

5. Opportunities should be provided to youth for learning by doing in the field of environmental problems. Institutional devices, such as the organisation of eco-development camps, in 'Tree for Every Child' and the improvement of environmental sanitation could provide opportunities for learning through work experience. School children and university students as well as the non-student youth should be given appropriate environmental education. School teachers, particularly in rural areas, should be encouraged to make children familiar with the natural endowments of the area.

6. Non-governmental and voluntary organisations should encourage and involve people in protecting their own environments. Specialised institutions should give appropriate support by way of training, audio-visual aids and teaching material to such organisations.

7. Suitable environmental management education institutions should be set up where a cadre of Environmental Managers could be trained to assist programmes sponsored both by government and non-governmetal organisations.

8. Environmental orientation of all those concerned with the designing and implementation of large development projects such as industries, dams and irrigation schemes, thermal power plants, mining, agriculture, fisheries, etc., is urgently needed. Priority should be given in training programmes to policy-makers and administrators in charge of such large developmental projects.

9. Greater regional and international cooperation is essential in the field of environmental education, so that all the inhabitants of the speceship 'Earth' will become aware of the inter-dependence existing in basic life support systems.

10. Since 1982 will mark the 10th anniversary of the UN Conference on Human Environment at Stockholm, special efforts should be made to make people everywhere aware of the need to achieve optimum use of resources in their own countries, environmental conservation and coordinated action in protecting shared assets.

Key Note Addresses

My Lessons of Environmental Education

R. MISRA*

I am thankful to the organisers of this symposium for giving me opportunity to share with you my experiences and views of environmental education. These are based on my experiences and interactions with the teachers and the taught besides studies and presentations and participation in the 1976 Jaipur symposium on the Teaching of Ecology and Environmental Sciences in India (see Tiagi and Gopal, 1978), the 1979 Delhi seminer on Environmental Education (see Bandhu and Aulakh, 1981) and the Jubilee symposium of the International Society for Tropical Ecology on Resources and Ecology held in October 1981 at Bhopal (Ed. Misra, *et al.*—in press).

My early understanding of the environment was developed through biology and ecology based on studies of reciprocal relations of organisms and the factors of the environment. The main features of these are exchange of energy and matter among organisms and between the latter and the factors such as gases, salts, water and organic compounds present in the ambient soil, water and air in the context of growth, dispersal and regeneration on variable time and space scales. The heterogeneity of the organisms with different life span and the changes brought about within the environment were also observed. Though individually the phenomena are temporal in behaviour the processes acquire perpetuity based on the daily acquisition of solar energy by the green tissues of plants which under favourable circumstances leads to organic productivity and evolution of the system as a whole.

While I was making the above observations in a lake (e.g. Misra, 1938) I had opportunity to consider these discrete but related ecological phenomena in terms of an ecosystem, a concept which was discussed three years earlier by Tansley (1935). Thus the entire lake was conceived as a unit which established its own functioning on account of exchanges between the water and the bed below and water and air above,

---

*Banaras Hindu University, Varanasi-5.

driven by the solar energy entering into the lake. The mediators of this functioning are the biosystems within the lake. Thus I learnt examining ecological systems both from holological and merological angles that is taking the whole lake as a unit built of sub-units or sub-systems. Extension of this concept to terrestrial situations as grassland, forest, savanna and ruderal ecosystems (e.g. Misra, 1959) revealed the same natural phenomena running through all biosystemic entities which made it possible to compare ecosystems on quantitative and qualitative bases.

The main feature of the aforesaid study was insight into hierarchical array of biosystems in which the upper level of the organisation acquired newer properties or additional informations not possessed by the subsystems individually. This complex situation was clarified on reading Feibleman's (1955) theory of integrative levels which would explain why scientists trained through reductionist approaches cannot easily grasp holistic concepts.

The next phase of my understanding of the environment is tied up with my involvement in the International Biological Programme of 1964-1974. During this period I comprehended ecosystems for human purposes as productive systems serving primary resources of man (Misra 1967, 1968, 1969, 1970, 1971, 1972, 1974).

My participation in the first decade of the UNESCO—Man and the Biosphere Programme which was simultaneously adopted by the Government of India taught me to treat man as the central feature of a changing biosphere (Misra, 1974) and extend the spatial vision of the environment from the local to the regional, international and global, in a historical perspective. In the formulation of the fourteen MAB projects as a member of the First International Coordinating Council and its Bureau I tried to relate all the ecosystem phenomena to man and his social activities. But I had difficulties in dealing with man himself as a part of the system on account of his non-material aspects as coping mechaniesm to changes within the system. The reciprocal impacts on man and nature resulting from his intellect, aesthetics and ethics through technology and socio-economic behaviour perturb the life support system which includes the resources. It is this life support system that constitutes the environment. The perturbations affect the diversity, the complexity and the stability of the subsystems.

I must admit that my entry into the subject of human environment was easy on account of my ecological knowledge. Discussions with the social scientists made me aware of the socio-economic problems. However, very few social scientists showed interest in integrating the cultural and the physical environment in the system context. Anderson (1973) advocated the use of the ecosystem concept in such context and stated: "The ecosystem's dual roots, firmly established in the natural and the social sciences, now may be utilised as a single nutrient source".

The ecologist's difficulty on the other hand, in developing the holistic concept of the human environment inclusive of the physical, biological and sociological interrelations stem from the non-uniformity of quantifying the involved parameters for dynamic modelling. Clark, Kitching and Geier (1978/1979) delineate "Ecology, which is concerned with material elements of the environments of mankind, investigates systemically aspects of the abundance, distribution and co-existence of populations of living organisms. It seeks to describe, and ultimately to understand, how those populations, functioning in concert, contribute to the accumulation and transfer of energy, and the cycling of matter.' They contrast the ecosystem from the man's life-support system which cannot be considered only in terms of population numbers and, the physical requirements and characteristics of the members of the human society. The aspects of the existence that affect happiness, inspiration and good fortune are very important. These authors refer to Skolimowski (1978) and Goldsmith (1978) for considering the study of philosophical and socio-economic questions from the aspect of quality of life. Therefore, they do not agree even to the use of the term ecology much less the concept of ecosystem, applicable to the science of man such as 'human ecology'.

But there the a body of ecologists who like to transcend material aspects of the human environment in considering the rural, industrial and the urban ecosystems. H.T. Odum (1971) has brought into his models even religion as a driving variable; so that systemic viewpoint has prevailed with a majority of them. The dissent arises when we ignore relating or unifying factors other than flow of energy and cycling of materials within an ecosystem. The maintenance of human ecosystems depends more on flow of ideas and informations. Such motivation brings about changes in the system. Hence, the study of environment has to be comprehensive enough in order to guide human social behaviour for the functioning and stability of the society.

Kothari (1980) like some other great scientists, goes beyond science in search of unifying concepts while discussing "atom and self" and rightly rejects view that such an exercise is as antiscience. Wojciechowski (1975) has presented the case for an ecology of knowledge, which arises logically for any extension of ecological thinking beyond ecology itself.

The cultural environment of man on the progress line of individual< society<mankind and the inner environment of man as ethics<aesthetics <technics indeed have parallels in the field of organismic ecology organism<population<ecosystem. Now we can look for reciprocal relationships in a triangular matrix of the three sets of environmental parameters. Such integration in a new discipline of environmental science for a university course is feasible. A multidisciplinary approach to the study of environment leads to fragmented personality and delusion. Ghosh (1981) has observed that the explosion of expertise in diverse disciplines has led to ceaseless quest for material progress which has spawned envy and greed. But the disciplinary focus in environmental studies is not going to create another set of expertise becouse knowledge after all is indivisible and it is exactly that kind of training which is hereunder proposed for environmental education.

Modern man is relentlessly pursuing the mundane while downgrading the higher, spiritual dimensions of existence. Man cannot fully comprehend the transcendal values of the environment necessary for its conservation through ecology and social sciences alone. The inner and the outer world of man has been well analysed in Indian philosophy. While discussing the unity of religions Swami Chinmayanand (1970) raised the spiritual standpoint and showed the relevance of higher consciousness in human behaviour. The thirteenth chapter of Bhagwat-Gita discriminates between soul and nature and then considers their interacting system as the highest entity. These aspects of our philosophy cannot be ruled out of scope of environmental education. The thoughts make us humble partners of the environment.

I have been labouring to bring out an integrated view of the environment so that its education may foster positive patterns of conduct towards our life support system in keeping with the spirit of the Tbilisi Declaration of the UNESCO-UNEP Conference. I have sat over numerous committees for framing integrated courses of environmental science without much success. The faculty members fought for maximum representation of their respective subject full of redundancy and irrelevance. It is obvious that in tailoring a course of environmental study we have to be discriminate, synoptic and holistic in our approach besides being realistic of the time and student-level frame. A visionary and missionary spirit has to be evoked among the faculty and the students. If we succeed in acquiring such leadership in our universities the problems of school, out of school, professional, in-profession and adult environmental education can be easily tackled.

The present trend of environmental education is fragmentary and most of the exercises are proving to be counter productive (see Misra 1981). Those engaged in the endeavour do not visualise the impact of their knowledge and practice on the environmental complex as a whole. Researchers analyse very successfully important aspects of environmental phenomena but they are oblivious of fitting and correlating the sectoral results in the systemic context.

I venture to lay down the following course modules just as a matrix for different combinations thereof:

1. Discrimination of objects as individuals, aggregates and systems. (See Rowe 1961).
2. Structural and functional level of integration; atoms<molecules <organelle<cell<tissue < organism < population ecosystem. (See Odum 1971).
3. Man, soul, society, nature and their interactions as in Indian philosophy.
4. Ecosystem: biotic and abiotic organisation; temporal and spatial boundaries; exchanges at the interface; flow of energy and nutrient cycling; sub-systems and trophic levels; input, output, feedback dynamics; man as a partner within the ecosystem; evolution of the biosphere; diversity, dominance, stability aspects. (See Odum 1971, 1977).
5. Parallelism between natural and man-made ecosystems; forest, grassland, crop fields, water bodies, rural, urban and industrial ecosystems. Ecosystem as productive systems. (Odum 1977).
6. Ecology of renewable and non-renewable resources; population-structure, dynamics and control including that of man.
7. Waste disposal by nature and by man, the problems of pollution and control.
8. Social organisation in plants, animals and man.
9. Analysis of man's behaviour towards society, nature, technology, cosmos and culture (See Kirpal, 1976 and Dunne, 1970).
10. Conservation, planning, institutionalisation and management.

11. Extension services.

12. Models of development for enjoyable, productive and spiritually satisfying life; buffers against the following developmental stresses: peace, population, health, agriculture, consumption, heavy technology, energy, distribution, economics, transportation, communication, urbanisation and pollution at local, regional, national and global levels. Halting and reversing the harmful trends.

13. Social ecology—(See Kochar, 1978).

References

Anderson, J.N., 1973. Ecological anthropology and anthropological ecology. In: J.J. Honigmann (Ed.), Handbook of Social and Cultural Anthropology, Rand McNally, Chicago, III, pp. 179-239.

Bandhu, D. and G.S. Aulakh (Ed.), 1981. Environmental Education. Indian Env. Sc. (8, Darya Ganj), New Delhi, pp. 140.

Chinmayanand, Swami. 1970. The unity of religions. In: F.P. Dunne Jr. (Ed.), The World Religions Speak on "The Relevance of Religion in the Modern World." World Academy of Art and Science. The Temple of Understanding Inc. Dr. W. Junk N.V. Pub. The Hague, pp. 82-85.

Clark, L.R., R.L. Kitching and P.W. Geier, 1978/1979. On the Scope and Value of Ecology, Protection Ecology, 1: pp. 223-243.

Feibleman, J.K., 1955. Theory of Integrative levels. Br. J. Philos. Sci., 5: 59-66.

Ghosh, S., 1981. The end of a civilisation. The Times of India, New Delhi, September 20 and 27.

Goldsmith, E., 1978. The ecological approach to unemployment. Ecol. Q., Spring 1978. pp. 32-73.

Kirpal, P. 1976. Non-Formal Education. Indian and Foreign Rev. 13: 19-21.

Kochar, V., 1978. Social ecology—an integrated disciplinary focus for social science involvement in ecological and environmental sciences.

In: Tiagi B. and B. Gopal (Eds.). Teaching of Ecology and Environmental Sciences in India, Int. Sci. Pub. Jaipur, pp. 109-120.

Kothari, D.S., 1980. Atom and Self. Meghnad Shaha Medal Lecture. Proc. Indian Nat. Sci. Acad., Part A, 46: 1-28.

Misra, R., 1938. Edaphic factors in the distribution of aquatic plants in the English Lakes. J. Ecol. 35: 411-451.

Misra, R., 1959: Environment, adaptation and plant distribution (Pres. Address, Bot. Sect.) Proc. Indian Sci. Cong. 35 KK: 96-107.

Misra, R., 1967. Form, function and factors in ecology J. Indian Bot. Soc. 46: 144-153.

Misra, R., 1968. Energy transfer along terrestrial food chains. Trop. Ecol. 9: 105-118.

Misra, R., 1969. Studies on the primary productivity of terrestrial communities at Varanasi—Trop. Ecol. 10: 1-15.

Misra, R., 1970. Save the tropical ecosystems. INTECOL Bull. London 2: 29-32.

Misra, R., 1971. Comparison of productivity of dry deciduous forests and grasslands of Varanasi. In: F.B. Golley (Ed.) Tropical Ecology Emphasizing Organic Production. Athens, U.S.A. pp. 279-293.

Misra, R., 1972. Soil fertility and nutrient dynamics in forest, grassland and crop land ecosystems and impact of industry on the soil. In: N.R. Dhar (Ed.) Soil Productivity. Nat. Acad. Sci. India pp. 269-276.

Misra, R., 1974. Environmental aspects of land use in semi-arid regions of Asia. In: M. Dworkin (Ed.) Environment and Development, Indiana, USA, pp. 32-42.

Misra, R., 1981. Environmental education in Indian Universities. In: K.C. Misra, *et al* (Ed.) Tropical Ecology and Resource Management. International Society for Tropical Ecology Silver Jubilee Symposium (in press).

Odum, E.P., 1971. Fundamentals of Ecology. Saunders, Philadelphia, 3rd Edn., 574. p.

Odum, E.P., 1977. The emergence of ecology as a new integrative discipline. Science, 195: 1289-1293.

Odum, H.T., 1971. Environment, Power and Society. John Wiley and Sons, N.Y. 331 pp.

Rowe, J.S., 1961. The level-of-integration concept and ecology. Ecology, 42: 420-427.

Skolimowski, H., 1978. Eco-philosophy versus the scientific world view. Ecol. Q. Autumn 1978, pp. 227-248.

Tansley, A.G., 1935. The use and abuse of vegetational concepts and terms. Ecology, 19: 284-307.

Tiagi, B. and B. Gopal, 1978 (Eds.) Teaching of Ecology and Environmental Sciences in India. Int. Sci. Publications, Jaipur, pp. 187.

Wojciechowski, J.A. 1975. The ecology of knowledge. In: N.H. Stenek (Ed.) Science and Society, Past, Present and Future. Ann Arbor, The Univ. of Michigan Press.

Major Requirements for Environmental Education

MARGARET R. BISWAS[1] and ASIT K. BISWAS[2]

Introduction

A better understanding of our environment is indispensable for its rational management because it would enable us to comprehend the environment's resilience to man's action and the maximum potential it may offer for sustained development of mankind. Such an understanding will also enable us to predict better the interrelated efforts of some of the major challenges facing the world today, among which are demographic changes; economic development; availability of food, energy and raw materials; development and utilization of new technology, rates of inflation and availability of investment capital. All these issues have significant impacts on the environment and the environment, in turn, affects developments in those areas.

Better understanding of the environment can only come through environmental education, and this is why environmental education is so important and essential at present.

Development During the Last Decade

During the last decade there has been major changes in the world as a whole in our attitudes to and perceptions of environmental problems. These changes can be discerned in both developed and developing countries, but the magnitude of these changes—as to be expected—vary from one country to another.

In developed countries, prior to 1970, public awareness of serious

---

[1] Balliol College, Oxford University, Oxford, England.

[2] President, International Society for Ecological Modelling; Vice-President, International Water Resources Association; Director, Biswas & Associates, 76 Woodstock Close, Oxford, England.

environmental deterioration was primarily limited to "shock" events. Thus, the shocking death of some 4,000 people due to the famous London smog of 1952 and another 800 deaths in New York in 1963 for similar reasons attracted widespread attention. Slowly deteriorating environmental conditions—like increases in water and air pollution, lack of land use planning or increasing noise levels—were mostly accepted as the price of progress. As people became more wealthier and level of education increased, they also became more aware of environmental issues. Publication of some books like *Silent Spring* by Rachel Carson in 1962 and *The Limits to Growth* by Meadows, *et al.* in 1972 not only contributed significantly to the ongoing environmental debate but also in some ways intensified it. Irrespective of whether one agreed or disagreed with the theses, put forward by these and other similar authors, there is no doubt that such events had a profound influence on the prevailing environmental thinking of the western industrialised countries. This can be demonstrated by comparing the number of articles on environmental issues published in *The New York Times* every year, which increased by slightly over 1100 per cent during the 10-year period of 1960 to 1970. Since 1970, however, the number of such articles publishes has declined, but even then the 1979 figure is 400 per cent higher than those published in 1960. Such trends were observed in other parts of North America as well.

So far as the developing countries are concerned, the overall trend was somewhat similar, even though these countries tend to be less homogeneous than the industrialised nations. In 1971, the United States Agency for International Development (A.I.D.) asked its overseas missions in 35 developing countries to canvass opinions in order to identify the most serious environmental problems facing those countries. A major conclusion of the resulting report (Office of Science and Technology, 1971) was that there was:

> "little evidence of awareness of environmental problems among the peoples of developing countries, or among their government administrators:..... Many countries are preoccupied with the development of their natural resources, and, to the extent that concern does exist for the environment, there appears to ibe apprehension that social and economic costs of environmental protection may very well outweigh the benefits."

The A.I.D. assessment was probably an accurate one since similar sentiments were expressed by several developing countries during the preparatory process of the UN Conference on the Human Environment held in Stockholm in 1972. There was a widespread feeling on the part of many such countries that environmental protection might hinder their development process, and thus keep them underdeveloped over a much longer period. This feeling on the parts of certain countries was so strong, the Secretary General of the Stockholm Conference, Mr. Maurice F. Strong, convened a meeting of international experts on environment and development at Founex, Switzerland, in 1971. The Founex Report (UNEP, 1981) clarified the conceptual relationship between environment and development, and put to rest the fear on the part of certain individuals by clearly indicating the complementarity between environment and development.

The Founex philosophy was reflected in the final Declaration that was agreed to at Stockholm (UNEP, 1981). Item 4 of this Declaration stated:

> "In the developing countries most of the environmental problems are caused by under-development........ Therefore, the developing countries must direct their efforts to development, bearing in mind their priorities and the need to safeguard and improve the environment."

Since the Stockholm Conference, much of the work on the environment-development interrelationship has been carried out by the United Nations Environment Programme under the brilliant leadership of its Executive Director, Dr Mostafa Kamal Tolba. Dr Tolba, who has always taken a keen personal interest in this subject, has made the world accept the general principle that environment and development are the two sides of the same coin. He has successfully argued that development must be sustainable, and in order for development to be sustainable, environmental issues must be explicitly considered. *Development without destruction* has been a major motto of UNEP, and coincidentally is also the title of Dr Tolba's latest book (1982), which incidentally clearly outlines the environmental philosophy which has evolved during the past decade. .

While prior to the Stockholm Conference, the real nature and magnitude of the environmental problems facing many of the developing countries were perceived somewhat vaguely, the situtation has become much clearer as more knowledge has become available. Many will now argue that poverty and environmental degradation will continue to co-exist, until we can better manage the impacts of a growing population on a limited natural resources base, whose productivity is not increasing commensurately.

While the principle of complementarity between environment and development mentioned earlier may not still be unanimously accepted all over the world, there is no doubt that the overall attitude has changed significantly in its favour since the Stockholm Conference, and to a great extent this has been achieved by better and more widespread environmental education defined in its broadest sense.

What is Environmental Education

What is environmental education? It has to be admitted that like education in any other broad area, there are no precise and universally acceptable definition. The best that can be done is to quote from Recommendation No. 1 of the first Intergovernmental Conference on Environmental Education, held at Tiblisi, USSR, in October 1977 (UNESCO, 1980).

According to this recommendation:

> "A basic aim of environmental education is to succeed in making individuals and communities understand the complex nature of the natural and the built environments resulting from the interaction of their biological, physical, social, economic and cultural aspects, and acquire the knowledge, values, attitudes, and practical skills to participate in a responsible and effective way in anticipating and solving social problems, and in the management of the quality of the environment.
>
> A further basic aim of environmental education is clearly to show the economic, political and ecological interdependence of the modern world, in which decisions and actions by different countries can have international repercussions. Environmental education should, in this regard, help to develop a sense of responsibility and solidarity among countries and regions as the foundation for a new international order which will guarantee the conservation and improvement of the environment."

The Recommendation No. 2 of the Tiblisi Conference (UNESCO, 1980) suggested some guiding principles for environmental education, which should:

"Consider the environment in its totality—natural and built, technological and social (economic, political, cultural-historical, moral, aesthetic);

Be a continuous lifelong process, beginning at the pre-school level and continuing through all formal and non-formal stages;

Be interdisciplinary in its approach, drawing on the specific content of each discipline in making possible a holistic and balanced perspective;

Examine major environmental issues from local, national, regional and international points of view so that students receive insights into environmental conditions in other geographical areas;

Focus on current and potential environmental situations, while taking into account the historical perspective;

Promote the value and necessity of local, national and international co-operation in the prevention and solution of environmental problems;

Explicitly consider environmental aspects in plans for development and growth;

Enable learners to have a role in planning their learning experiences and provide an opportunity for making decisions and accepting their consequences;

Relate environmental sensitivity, knowledge, problem-solving skills and values clarification to every age, but with special emphasis on environmental sensitivity to the learner's own community in early years;

Help learners discover the symptoms and real causes of environmental problems;

Emphasize the complexity of environmental problems and thus the need to develop critical thinking and problem-solving skills;

Utilize diverse learning environments and a broad array of educational approaches to teaching/learning about and from the environment with due stress on practical activities and first-hand experience."

While the above aims and guidelines give us some idea about environmental education, it has to be admitted that they are somewhat general and broad, with rather poorly defined boundaries. Accordingly there are major differences of opinion among experts as to what constitutes environmental education or rather what does not! This should not be surprising because such differences of opinion are likely to persist in any new subject like environmental education, which by its very nature of interrelatedness between physical, social, economic. legal and cultural factors, is likely to remain complex and perhaps to some extent ambiguous for some time to come until it is properly established. This state of flexibility, however, could be construed to be a challenge as well as a golden opportunity, since it gives us the freedom to develop new directions to the education, new dimensions to the problem and new courses of action.

Major Requirements for Environmental Education

Within the general framework of environmental education discussed earlier, there are several major requirements which are likely to contribute to its success. Because of paucity of time, we shall discuss six major factors. These are:

1. Interdisciplinarity
2. Interrelatedness
3. Flexibility
4. Non-dogmatic
5. Emphasis on problem-solving
6. Practise what you preach.

Interdisciplinarity

An implicit but principal assumption of many professions and university departments is that individual branches of science, both natural and social, can be interpreted as a basis for reality. Consequently, it is assumed that nature is organized in the same way as the professions are. Thus, one hears discussions of engineering problems, biological problems, environmental problems, social problems, chemical problems, medical problems, etc. In a real world, of course, nothing can be further from the truth. A problem is a problem, and the addition of the professional adjective only indicates our ways of perceiving and analysing the problem. The method of analysis is generally dependent on the analysts' training and experience, and this very often leads to the introduction of significant biases in the resulting analyses, which ultimately affects the decisions taken to solve the problems.

Individuals trained in different disciplines may look at a common problem to be analysed and solved in somewhat different fashions, depending on their education, background, and experience. The point can be best illustrated by the following story. The manager of an old building once received complaints from his tenants regarding the long waiting time for elevators. The manager called in his engineers and asked for possible solutions. The engineers suggested three alternatives: add extra elevators, replace old elevators with more efficient new ones, or use a banking system. The manager rejected the first two because they were too expensive for an old building and the third because it reduced the waiting time only marginally. The manager, however, had a friend who was a psychologist and who heard of this dilemma The psychologist offered a simple solution: install mirrors in the elevator lobbies. This surprisingly enough stopped all the complaints. The mirror gave the ladies waiting for the elevator an opportunity to do some adjustments, and the men could look at the ladies in the mirror without any embarrassment!

Whether the story is true or not is really unimportant: what is important is the fact that the psychologist saw the same problem that was facing the engineers in an entirely different light. The engineers attempted to reduce the actual waiting time by technological means, but that solution did not occur to the psychologist. His solution was not to reduce the waiting time but to make it look like it had been reduced, and this happened to be an acceptable solution. The point we are trying to make is that it is desirable to have an interdisciplinary team for environmental planning and management because different disciplines could perceive the same problem in different lights as a result of their training and background. Without such interdisciplinary approaches there is a possibility that biases may be introduced into analyses and policies which may go unchallenged and undetected. Such a situation is bound to create problems.

Interrelationships

There is often a tendency to consider one issue or topic at any one time without considering its potential impacts on other related issues. The principle of reductionism is widely accepted and used, primarily because it is much easier to handle a problem with fixed boundary conditions.

While the interrelationships concept is not novel, excessive preoccupation with rapid development and technological advancement has meant that, very often, whatever knowledge of interrelationships was available tended to be disregarded. However, attempts to solve seemingly technical problems such as desertification, loss of productive soil or deforestation have indicated that emphasis should be placed not only on such physical factors as climate, soil type, modes of cultivation or land-use patterns, but also on diverse factors including demographic trends, types of technology used, levels and distribution of income among the population, consumption patterns, cultural habits and educational levels of the inhabitants, etc. Without such a holistic approach, actions taken to solve specific problems may give rise to several other unintended side-effects, the sum total of which could even be worse than the problems initially addressed. This aspect, however, is quite often overlooked because in many cases those who suffer from the adverse side-effects of improperly balanced development are the poor, inarticulate and politically weak sections of society.

It is equally important to stress that the major issues facing a country from a complex system of cause and effect relationship within which the dynamics of the future of the nation will be determined. It is not in any of the issues—though they may be very important individually—but in their interactions, that the future will be shaped. For example, increase in population and provision of basic human necessities to each individual would require more food, energy, and raw materials: intensifying the supply of food would mean more land, water, energy, and fertilizers; the energy crisis and higher oil prices mean less energy available to increase food production, to alleviate fertilizers shortages or further industrialisation; and the common denominator in virtually all responses to these problems must include more capital, more technology, and more trained man-power. It is here that these concerns inevitably merge with the important issues of war and peace, international monetary and trade relations and political alignments. Each affects and is affected by the others. This system of relationships is global in scale. That is not to say that all global problems can and should be met with global solutions: because there are few global solutions. But they can only be understood and dealt with in a global framework, within which there can be a wide variety of national and regional responses. Such important consideration is seldom stressed in most educational systems practised at present.

Flexibility

The increasing complexity and magnitude of environmental problems mean the educational process must be flexible, and should be capable of producing both generalists and specialists. It is equally important to ensure that both specialists and generalists can work together, with mutual respect and harmony and without rançour:

During the past decade, the complexity of environmental problems has meant new areas of specialisation. This has created some problems in terms of decision-making, since a wider spectrum of knowledge is now essential for policy-making. This means either the decision-makers themselves must have special knowledge in many specialised areas or they have at their disposal people who have such expertise. In either case, there is an urgent need for a new kind of professional who can successfully direct multi-disciplinary staff handling complex problems. They should be familiar with techniques and goals of the specialists, understand the technical terms and methodologies used by other disciplines and have a clear view of the breadth of the problem, and its importance in the political process. For the lack of an appropriate term to describe this new cadre of professionals, we may call them either "generalised specialist" or "specialised generalist". These are people who may have started as generalists but specialised later or vice versa. In either case, they are specialised enough to lead a team of specialists and at the same time generalised enough to realise the impacts of technical decisions on wider physical, social, biological and political systems. Development of such professionals is not going to be an easy task, but undoubtedly a most crucial one if serious future environmental problems are to be successfully avoided.

Non-dogmatic

In recent years there has been a tendency to introduce certain dogmatic ideas in the environmental education process. We shall discuss one example here.

There is much controversy at present on the scale of projects that are beneficial to countries. One group preaches that "small is beautiful" but another strongly asserts that "big is magnificent". Any objective person who has worked in the development area in developing countries, or for any country for that matter, has to admit that there are a variety of soultions to a specific type of problem. The optimum solution is not identical in all locations: it is a function of several interrelated factors. Thus, small is not always beautiful and big is not necessarily magnificent since there are no unique solutions that are both optimum and relevant universally because of differing physical, social, economic, cultural and political conditions all over the world. Thus, environmental education should emphasise uniqueness of each situation. As a rule one should be sceptical of universal solutions.

Emphasis on Problem-solving

Environmental education should emphasise problem-solving, and once the solutions are known and agreed to, people should be encouraged to apply them in real world. There is a too prevalent tendency to spend months and often years on analyses, and once the theoretical work is complete, many feel they have completed their work and have no compulsion or interest to see if the solutions proposed are applied. Thus, too often one sees what can only be termed "paralysis by analysis". Admittedly analyses are absolutely essential ingredients for environmental policy formulation, but it must be realised that in such cases it is not the *means* to the end that count—though they are undeniably important—but it is the *end itself*: After all of what use are the analyses if we cannot use them to solve real world problems? We have no objection to people living in ivory towers, provided *it is not their only place of residence!*

Attempts to develop a positive problem-solving attitude through environmental education has to emphasise creating a new mentality among the students: one we would call John Roebling type of mentality.

John Roebling had a dream—a great dream—but its effective culmination depended on his ability to spin wire. He never gave up. He designed and built the machines to spin wire and through his son successfully carried though the construction of the Brooklyn suspension bridge. He died figuratively looking out of the window of his house in Brooklyn while his son was in the process of completing the construction of the bridge. The problem we face with environmental sciences is that we currently do not have enough people who have the mentality and characteristics of a John Roebling, who are willing to innovate, apply theory to practice and are quite prepared to get their hands and feet dirty so that the task is completed satisfactorily and usefully.

Furthermore, it is not exactly unusual to find that sometimes analyses are more sophisticated than their end-uses warrant. This is especially relevant in the area of mathematical modelling. We know of several cases where the analysts got carried away with the mathematical sophistications and then went out on theoretical excursions on a detailed simulation of the twentieth-order situations when the zeroth-order situation is completely controlled by the noise and thus improperly understood. Proper environmental education should be able to prevent this type of situation. One is sometimes reminded of Pooh Bah in *The Mikado*, who when asked to explain a piece of mendacity for which he was about to be tried, and when asked why he told the particular lie, replied: "Well, it was merely corroborative detail intended to add versimilitude to an otherwise bald and unconvincing narrative."

Practise What You Preach

It is indeed a major dichotomy in the present world that many people preach one thing, but practise another. Their thesis seems to be "do as I say and not what I do."

We have participated in numerous workshops and training sessions over the years where teachers preach sharing of resources, use of appropriate technology and the need to sacrifice by the more affluent individuals so that the poor can be better off. Yet, in their real lives, they do just the opposite. They stay in the Hiltons or the Intercontinentals, where often the price of the hotel room only for one day is higher than the monthly salary of a new graduate of that country, and dine at Maxim's with champagne and caviar. This champagne and caviar international jet-set, to whom Mahatma Gandhi termed "armchair socialists" can be aptly applied, want others to sacrifice, but not themselves. This in the area of environmental education will just not do! It is important and absolutely essential that the teachers and leaders should set examples by practising what they teach.

Concluding Remarks

The Stockholm Conference proclaimed: "to defend and improve the environment for present and future generations has become an imperative goal of mankind." This undertaking clearly implies the urgent necessity of disseminating knowledge about the environment to all members of the community who can then effectively participate in sustainable development, which will contribute to the improvement of their quality of life. As Dr Tolba (1982) has said elsewhere: "environmental measures in every country call for active citizen participation, which will only be effective if based on and linked to education for the public at large."

We are of course not suggesting that environmental education alone and by itself will solve all environmental problems. What we are saying is environmental education, in the broadest sense of the term, is a prerequisite for better environmental management.

References

Office of Science and Technology, Bureau of Technical Assistance, July 1971, "Environmental Problems in Selected Developing Countries", A.I.D., Washington, D.C., p. 10.

Tolba, M.K., 1982, "Development Without Destruction", Tycooly International Publishing Ltd., Dublin, Ireland.

UNEP, 1981, "In Defence of the Earth: The Basic Texts on Environment, Founex, Stockholm, Cocoyoc", Executive Series 1, UNEP, Nairobi, 119 p.

UNESCO, 1980, "Environmental Education in the Light of Tiblisi Conference", Education on the Move 3, UNESCO, Paris, 100 p.

Save the Soil--Save the Nation

J.S. KANWAR*

"The wealth of a nation is in its soil, its water, its forests and the things they produce and reproduce" (Richard L. Porlet). Soil and civilisation go together. The nations which neglected their soils have gone down in the history. Nearly 2300 years ago Aristotle stated "Soil is the stomach of the plant". Can we hit at the stomach of the plant without hitting at our own stomach?

Quite often people talk of land, fight for land but most often they ignore the third dimension of the land, which makes the land a soil. Nation's armies fight for an inch of land, but no body seems to shed a tear when millions of tons of top fertile soil are lost before their eyes by a single storm of rain or wind. Can you believe that India is losing 5 to 6 thousand million tons of top soil every year but did you see any agitation for prevention of this loss or any protest against the misuse of the soil.

The gradual "inch-by-inch" nature of soil erosion is both a blessing and a curse. It is blessing in that it takes time for erosion to produce measurable devastating effects. It is a curse in that it doess not easily catch the eye of the public except when it causes calamities, such as drought and floods. Huge public expenditure is incurred in fighting flood's damage, desilting, costly water reservoirs, protecting dams, repairing highways, and compensating for loss of property and crops. The ravages by floods in Rajasthan this year, in Uttar Pradesh in 1980, in Gujarat in 1979, and in Bihar a few years ago, are grim reminders of the havoc that these floods are causing. Are we not silent spectators to this drama ? Are we not losing our most valuable heritage that nature has taken millions of years to build and that supported our nation for thousands of years.

---

*Director of Research, International Crops Research Institute for the Semi-Arid Tropics, ICRISAT P.O. 502 324, Patancheru, Andhra Pradesh, India.

We are in danger of losing sight of the fact that the land is limited and that the number of people it is required to support has more than doubled in 30 years; and this process of doubling continues unabated. More people mean many times greater need for food, fodder, fiber, fuel, and timber. These pressures set up a chain reaction involving extension ofcultivation to more marginal lands, more exploitative agriculture, more deforestation, and more overgrazing and hence more erosion. Every development project, whether it is construction of an irrigation project, highway, airport, railways, factory, or a new housing colony results in ecological disturbances of the environment and more complex problems of soil conservation. Are we geared to meet this situation? It is not the case of India alone, the whole world has the same problem, it is a question of degree. What takes nature millions of years to develop as a productive top soil man can destroy through his negligence and reckless activities in a few days, months or years. At a rate of 10 tons/ha loss of top soil, we may loose the entire top soil in 250 years.

Do we know that each year the world's finite capacity to grow food and fibre is being reduced by the loss and degradation of its soil. *First*, many of the world's soils are losing the minerals and organic matter that makes them fertile, and these materials are not being replaced, in most cases, nearly as fast as they are being depleted. *Second*, some soils are being degraded by increase in their salt or sodium content, by waterlogging, or by poisoning through indiscriminate application of agricultural and industrial chemicals. The former is more evident in countries like India and the latter in highly industrialised countries of Western Europe. *Third*, soil is being lost physically through accelerated erosion from the action of water and wind and by undesirable changes in its structure. *Fourth*, millions of hectares of good farmland are being covered by water for reservoirs or by buildings asphalt, and concrete as urban areas expand into the countryside. The net result of these multiple assaults on the world's agricultural soil and land will be that the planet can feed, clothe and house fewer people at a time when world population is growing and expectations are arising for a better life.

Indian Situation Analysed

Let us analyse the Indian situation. Since the United Nations Conference on Environments, which I had the opportunity to attend, a number of papers have appeared emphasising the seriousness of land degradation, but the world has not yet evolved a rational policy on soils. In India we have industrial policy, which we accepted soon after independence and today we can rightly boast of a good ranking in the list of industrialized countries may be of the third world, but do we have a soil's policy? We do need a land charter and soil's policy for development as well as our survival. Out of 328 million ha total land area, 18 million ha is under urban and non-farm uses, 21 million ha is non-cultivable, about 85 million hectares under forests, non-descript pasturers, and grazing lands, 40 million ha is potentially arable but uncultivated waste land and only 143 million ha is under agricultural uses. The National Commission on Agriculture (1976) estimates that nearly 150 million ha approximately half the total land area of the country is in various stages of degradation due to water and wind erosion. Tejwani (1982) estimates that 56 per cent of the agricultural land, 75 per cent of fallow land, 86 per cent of the cultivable waste land, 95 per cent of so-called grazing lands and less than 33 per cent of the area under forest and trees is suffering from soil erosion problems.

Dass and Mukherjee (1980) put these estimates a little higher and consider 175 million ha are subject to soil erosion and other degradation hazards. The problems include water and wind erosion in cultivable and non-cultivable lands, desertification, salinisation, alkalisation, waterlogging, ravines, shifting cultivation and other land degradation processes which account for this land deterioration. About 40 million ha of potentially arable land has been estimated by the National Commission on Agriculture lying barren. Another 43 million ha is under highly deteriorated problem soils such as saline alkali soils, waterlogged soils, ravines, deserts and suffering from many other constraints including ravages by shifting cultivation.

Mr. Vohra (1980) has put these estimates still higher and argues that 200 million ha is degraded due to various causes and deteriorated to various degrees. Though no two estimates agree the fact remains that about one half of the land is affected by degradation in various ways. Thus, it is not surprising that more than half the population is below the poverty line. We call land the mother earth. Can you ever hope to see a healthy child from a sick and impoverished mother?

Natural Disasters and Soils

Land degradation is the cause as well as the effect of a number of disasters which we consider national disasters. Quite often erroneously we blame the nature for its wrath and fury without realizing that we are the cause of it and they are directly or indirectly related to mismanagement and unwise use of soil.

Floods

According to National Commission on Floods (1980) 40 million ha are subject to floods throughout the country. The core of the problem lies in the Indo-Gangetic basin particularly in the States of U.P., Bihar, West Bengal, Assam, Orissa and on an average about 8 million ha are regularly visited by floods every year causing an annual loss of about 250 crores of rupees. The annual loss during 1971-80 is estimated at 739 crores. The floods are considered a disaster and wrath of nature and annually crores of rupees are spent in meeting the disaster. It is often not realized that their intensity and extent could be much less but for man's thoughtless action, over exploitation of natural vegetation and forests, mismanagement of soils in the critical areas of watersheds and reduction in the capacity of agricultural lands, to retain water. Thus, soil management is the key to the problem of floods. The most disquieting feature is the rapid increase of the flood affected areas since 1950. The National Commission on Floods has remarked that from 25 million ha in 1950 flood affected area has now grown to 40 million ha. One could argue about the accuracy of these figures but could not ignore the statistics quoted by Member (Floods), Central Water Commission* Govt. of India, in the International Conference on Flood Disasters, held at New Delhi recently, who stated that from an average 6.95 million ha during 1953-60 the average flood affected area increased to 11.49 million ha between 1971-80. The main reason for this change is the ruthless deforestation, destruction of vegetative cover, lack of soil conservation in the agricultural and non-agricultural lands in the catchments and extension of agriculture to marginal lands without adequate soil conservation measures. Mr. Dass in his paper in the above mentioned conference stated that it was possible to moderate the intensity of floods and their adverse effect by changing the soil moisture storage qualitatively and quantitatively through land-use management and by increasing the ability of watershed to absorb, utilize and affect delayed release of water.

Droughts

The other national disaster for which the country has to spend crores of rupees every year in the form of relief or for counteracting its ravages of reduction in crop production and instability of production is the drought. Nearly 80 per cent of the area of country is semi-arid and arid and droughts of a few days to few weeks are most common throughout this area. There can be climatic drought, soil drought and often both. Insufficiency and illdistribution of rain is one aspect which is not changeable. The capacity and ability of soil to absorb and hold the water and use it effectively is manageable to a considerable extent. Through

---

***Keynote paper by Gurcharan Singh, Member (Floods), Central Water Commission, Government of India.**

mismanagement of soils, lack of vegetative cover and poor structure, millions of ha of droughtprone areas have lost their capacity to make the best use of the rain. The problem is worst in shallow soils. Thus some soils are inherently droughty because of their shallow depth but others are made more droughty by man. You would be shocked to know that in Sholapur region of Maharashtra in 75 years the area under deep soils (>45 cm) decreased from 46 to 29% (Patel, *et al.* 1981). Thus before our own eyes these profound changes are occurring. Worst affected are cultivable waste lands and denuded forest and grasslands which everybody seems to have the right to exploit but nobody considers his duty to protect and improve. Many of these are government lands or village common lands. Most susceptible areas are of peninsular India, western India (Rajasthan, Gujarat, Maharashtra) and parts of U.P., Bihar, Haryana and Punjab. Dass and Mukherjee (1980) concluded that the total area susceptible to drought is about 259.7 million ha which is nearly 70 per cent of the country's total land surface area. Modern technology no doubt has been able to blunt the effect of drought considerably but still it remains most destabilising factor in agriculture of the country. Extension of irrigation is considered a means of fighting the drought but with all our best efforts still one half of the cultivated area will remain unirrigated, which is the core of the drought-prone areas. The only hope of this area for fighting droughts is through sound management of rain water and of soils. The main question is whether the country spends funds on relief measures to mitigate the hardship to people or makes a deliberate effort to develop the land and to introduce a technology to fight droughts and to give more stable production. We can find enough funds for meeting the disaster but not for soil improvement.

The rain water management technology assumes a great importance in India and national policies should aim at encouraging the effective use of rain water. The INSA Seminar, 1980, on Rainwater Management gives concepts and policies for this system and presents an evidence of the availability of such a technology for meeting the challenges of drought in the SAT areas of India. An effort is needed to transfer this technology which has potential of increasing crop yield as well as reducing soil erosion in millions of ha of land in India. Water can be a catalyst of a change. The story of Sukhumajri is an example.

National Problems Related to Soil Constraints or Poor Soil Management

Now I deal with another category of problems, which are not called disasters but are of such dimensions and nature that they are of national significance. They are related to soil constraints and poor soil management.

Food Shortages (Food Famine)

Food shortages have been common in India and even after more than 30 years' developmental activities since independence, we are still not free from the problem of food shortages. No doubt famines which were of common occurrance have become less conspicuous but the food imports still persist. From 143 million ha of cultivated land which includes more than 52 million ha of gross irrigated land, still our average production is less than 1 ton/ha. There are variations from state to state, and district to district but the fact remains that we are producing only 1/5th to 1/4th of optimum yield potential of these lands. The most unsatisfactory situation is of kharif cultivated area which show too much fluctuation in yield from year to year, worst instability being on oilseeds and pulses. We often blame the weather but even in irrigated areas the yields are disappointingly low. Take the case of wheat, we have average yield of 1694 kg/ha from irrigated areas as against more than 500 kg in Netherlands and 3616 kg in Mexico. The average yields obtained at the research stations, at the farms of innovative farmers and the average yields of the country show a tremendous difference. The ratio is as wide as 4:2:1 in irrigated and 7:4:1 in unirrigated areas.

I am convinced that even half of our 52 million ha of gross irrigated area if cropped intensively and with all the inputs is capable of producing more than 200 million tons of food grain and meet our total requirement of food grains even in the year 2000 A.D. The results of national demonstrations on farmers' fields indicate that the optimum production potential is more than 400 million tons. But this is possible to achieve not with traditional technology, traditional varieties and subsistance farming. It is possible only with modern technology. This is a dynamic process in which input-output relationship has to be kept in view to ensure optimum returns and to avoid any ill effects of inputs.

The non-irrigated rainfed lands are producing less than 800 kg food grain per ha. Besides their low productivity, they are more prone to erosion by wind in arid areas and by rain water in the semi-arid areas. Even the practices of cultivation such as following during monsoons, removing all the stubble, overgrazing, ploughing up and down, and neglecting use of fertilizers and manures and traditional technology for crop production results in accelerated erosion and poor production. We have sufficient experimental evidence that these rainfed lands are capable of producing many times more than they are doing now, provided we remove the soil constraints and manage them efficiently. ICRISAT's experience on deep black soils (Vertisols) has shown that 12 million ha of these which remain uncropped during monson losing on an average 25% of rain water and about 6.9 tons of soil per ha annually could produce nearly 36 million tons of additional food grains (Kanwar, 1981). With appropriate technology, Vertisols will produce not only 500 per cent more food, give 600 per cent net returns and reduce soil loss by about 80 per cent and water loss by 60 per cent. Similar experience exists in case of Alfisols (Red soils) which occupy 94 million ha in this country. The experience of Soil Conservation Research Center, Dehra Dun and All India Dryland Research Project, provides convincing evidence of the reduction in soil and water loss that could be affected through improvement in productivity of the land.

An idea of soil losses per ha is given in Table 1.

Thus it is logical to conclude that the low productivity of the soil is responsible for extension of agriculture to marginal lands, accelerating erosion, and increasing soil degradation. By increasing productivity the country can retire or revert marginal lands to forests and grasslands and improve the ecosystem. It is criminal to be contended with low productivity.

It is not only the agricultural lands whose productivity needs to be increased, the forests and grasslands also are in need of increasing the productivity as more vegetative cover would mean less erosion and less loss of water through runoff.

For saving the precious heritage of the soil, we should consider a few points. These are:

1. Soil should be considered a national asset and every land holder be considered its custodian and expected to use it according to its capability, to realise its optimum potential.
2. It should be recognized as a national policy to bring the deteriorated lands back to normal production and to prevent the deterioration of the land. Tax relief incentives and other monetary benefits to encourage this process should be provided.
3. Every one should make an effort to return to the soil what he removes and improve it further so as to leave a better soil for the future generations.

Fuel Wood Shortages

The shortage of fuel wood and increasing demand for it by the galloping population leads to rapid deforestation of areas and degradation

TABLE 1

Annual Soil Loss ue to Water Erosion on Cultivated Fields

	Location	*Soil loss (ton/ha)*	*Source*
1.	Dehradun	29—38	Consolidated Ann. Report of Soil Cons. Res. Demons. Trg. Centre, 1968.
2.	Agra	20—32	,,
3.	Kota	2.5—4.0	,,
4.	Ootacamund	25—39	Soil and water cons. res, 1956-71, ICAR Publ. 1973.
5.	Vasad	2.3—20.4	,,
6.	Manjri	17.5—90	Kanitkar, Dry Farming in India, ICAR Publ. 1968
7.	Sholapur	42—75	,,
8.	Bijapur	23.0	,,
9.	Hagari	16.0	,,
10.	ICRISAT, Patancheru		J.S. Kanwar (1981). Problems and potentials of Vertisols and Alfisols—the two imp. soils of SAT-ICRISAT experience. Intl. Symp. on distribution, characterization and utilization of problem soils Tsukuba, Japan, Oct. 19-26, 1981
	(a) Vertisols (Kharif fallow)	6.9	
	(b) Alfisols	2.8—5.0	
11.	Shillong	5—76	A. Singh (1981) Engineering Procedure for efficient land-use. J. Agr. Engg. March, 1981.

of land. The National Commission on Agriculture has estimated that the country may need 225 million tons of fuel wood to meet its minimum needs for the domestic purposes by 2000 A.D. There is a good deal of evidence that ravine lands, saline alkali soils and all the lands considered unsuitable for agriculture could be put under forest and fuel wood plantation. The techniques developed by the Central Soil Salinity Research Institute, Karnal, of planting quick growing trees by drilling holes in the sodiac soil and using gypsum manure, fertilizer and rice husk for facilitating aeration and water penetration can convert million of ha of such waste lands in U.P. and other states into good forest lands. This may be the easiest way of making the best of these deteriorated lands and improving the ecosystem.

Water and Energy Shortage

The scarcity of water and energy are also partly the results of indiscriminate deforestation and absence of soil conservation in the watersheds. The water runs off the bare ground of soaking in, thus the capacity of the catchments to yield continuous supply of water, particularly during the dry season and to keep our power plants running is reduced. We have also neglected 5 lac tanks which dotted whole of the peninsular India and some parts of north India as well. We have also encroached upon their watersheds and allowed them to be silted up and lie out of repair. This has seriously affected the ecosystem and created more runoff water which causes damage to agricultural lands and reduces availability of water in the dry periods. A vigorous soil conservation program in the watersheds and afforestation of denuded forests and barren non-agricultural lands is needed. To solve the problem of shortages of the present and to provide for the future, techniques are available to prevent erosion from different types of soils, but unless the soil conservation becomes a mass movement and individual farmer's priority program the job can not be done. Nation-wide efforts are needed to remain as much water in situ as possible and harvest excess water in tanks and small reservoirs all over the watersheds in the country. Unless this is done the huge loss of rainwater which goes to the sea unutilized cannot be reduced. While the country suffers from droughts, water shortage and power shortage, the mighty rivers carry the good quality water to the ocean. Isn't it strange.

Siltation of Tanks and Reservoirs

One of the most serious problem experienced in India is siltation of the costly irrigation water reservoirs, dams, canals, and tanks. Due to siltation their effective life is being reduced rapidly. The actual rate of siltation of dams is many times faster than it was estimated by the designers. The trend of sedimentation varies many times the designed capacity (Table 2) The life of irrigation dams is shortened. There are serious doubts about the soundness of large dams which besides being too costly require deforestation of thousands of hectares. A conservative estimate shows that 400,000 ha of land had to be deforested for construction of dams from 1952 onward whether it is Nagarjunasagar Dam in A.P., or Bhakra Nangal Dam* in the alluvial soil region of Himachal Pradesh, the story is the same. They are silting up at a fast rate and thus reducing their effectiveness because of the serious erosion problem in the watershed areas.

TABLE 2

Observed Sedimentation Rate Expressed as a Percentage of Designed Sedimentation Rate For Some Selected River Valley Projects in India

Name of River Valley Project	**Observed sedimentation rate expressed as a percentage of designed sedimentation rate (%)*
Tungabhadra	420
Bhakra	143
Hirakud	143
Ramganga	410
Nizamsagar	2290

* Computed from the data given in "Handbook of Sedimentation", Govt. of India, Ministry of Agriculture, New Delhi, 1972, pp. 7-8 and 7-9.

The system of small tanks needs a critical look. These tanks have sustained Indian agriculture for hundreds of years and they can still do it, provided we protect them. Small is beautiful and more efficient too.

Salinity and Alkali

Most of the area in the country being semi-arid and arid, the problem of salinity and akali is a natural phenomenon. It has been estimated that about 7 million ha are affected by salinity and alkali and 6 million ha with waterlogging and the problem is increasing in the newly irrigated areas.

The major causes of the problem are interference with the surface and subsurface drainage, seepage from the canals and irrigation channels and poor management of water. Irrigation can take considerable blame for rendering million of ha saline mostly under arid conditions and alkali (sodic) under semi-arid conditions. Abrol and Bhumbla (1971) have estimated that more than 2.5 million ha of sodic soils are lying waste in U.P. and adjoining areas of Haryana and Punjab. The sodic soils have low infiltration rate because of high amount of exchangeable sodium. Thus most of the rainwater runs off the ground causing flash floods and damage to crops in the surrounding areas. All new irrigated areas are faced with this problem particularly in the black soil region. The history of the Chambal project is an index of the rate at which the soil deterioration in the black soil region occurs. What happened in canal areas of alluvial region in 30-40 years may perhaps happen in less than 10 years in black soil region because of the nature of the clay and poor surface and subsurface drainage. It is unfortunate that irrigation is considered only an engineering feat and the duty of the engineer ends after the construction of a dam. The drainage and development of proper system of water use and management is completely ignored with the disappointing results. Low realisation of irrigation potential, deterioration of land and low payoff from the costly irrigation projects is the result.

---

*It is 400 per cent in the former and 133 percent in the latter.

Prevention of the problem in the newly irrigated areas and reclamation of the deteriorated soils in other areas is the answer. The recent work at the Central Soil Salinity Research Institute, Karnal has shown that these deteriorated soils are highly responsive to management including land shaping, water management and use of improved technology. Use of gypsum fertilizer m [illegible] and other agronomic practices has produced from these deteriorated soils food grain more than 7 tons/ha/annum at the farmers' fields. The technique is becoming popular with the farmers who find the operation very remunerative. Fortunately, the quality of ground water in the sodic soil areas of India is good and can be used effectively for crop production. It is unfortunate that we have ignored the basic principle that irrigation and drainage go together and water alone is not enough for obtaining high production from the irrigated areas. We have also ignored the lessons from the history that many civilisations were ruined because of lack of appreciation of these principles. Pakistan has about 11 million ha affected by salinity and alkalinity out of 15 million ha of irrigated area. The story is similar in Iran, Iraq and Egypt. With more irrigation we can develop better agriculture but by ignoring the basic principles which can make irrigation productive, we can ruin our national heritage. Thus effective field drainage to take away excess of salts from the irrigated areas of arid and semi-arid region of the country is essential for getting the maximum pay off from the irrigation projects and for preventing the deterioration of environments.

Desertification

National Commission on Agriculture (1976) has estimated 32 million ha is suffering from wind erosion out of which 6.5 million ha is under sand dune and the rest of the area shows effect of wind erosion to varying degrees. We can go on arguing whether the Rajasthan desert is extending to good agricultural lands or not, but fact remains that over grazing, over stocking, deforestation, bringing under cropping those marginal lands which are more suitable for controlled animal grazing, lack of soil conservation measures and nutrient and moisture stress aggravate the desertification process. Man is to be blamed more than nature for the increase in desertification. Man can make the deserts bloom again not only through irrigation but also by proper use of technology suited for arid areas. The Central Arid Zone Research Institute, Jodhpur has done an excellent work in developing technology for protecting these lands. What is needed is an action plan to make use of the technology.

Other Special Problems of Soil Erosion

In the foregoing pages, I have described a few problems which become the national disasters and catch the headlines in the newspapers. The soil conservationist will say these are nothing but effect of water and wind erosion. These are not the only aspects, there are many other localized effects such as land slides in the Himalayas, ingression by sea on the coast of Kerala and other coastal states, ravines of the Chambal, Jamuna, Sabarmati and other rivers in Uttar Pradesh, Madhya Pradesh, Rajasthan, and Gujarat which bear the stamp of man made problems. The solution of all these lies in the proper management of soil and water. If this process goes unchecked, we will rue the consequences.

Soil Health

In the tropics and sub-tropics the rate of oxidation of organic matter is rather high and as the new lands are opened up for cultivation the organic matter starts disappearing rapidly. Under shifting cultivation system the rate of loss of organic matter is rather high. The recent trend of 5 year rotation instead of 20-25 years in the shifting cultivation, areas under tribal communities of India is causing accelerated erosion and impverishment of the soil.

The exploitative agriculture aiming at maximising production per unit area per unit time also means greater strain on the natural reserves of the soil and unless the input-output relationship is maintained, serious problem of soil exhaustion can become evident. Judging from the trends, I feel if fifties was a decade of N deficiency, sixties of P deficiency, seventies of Zinc deficiency and the eighties may become a decade of multiple nutrient deficiency. Today, Punjab is talking Mn and Zn deficiency, Tripura of Zinc, Gujarat of B and Ca and many states of Zn. Although gross statistics are misleading, in 1969-52 per cent soils were deficient in N and in 1980-62.7 per cent have been reported to be deficient. The consumption of P and K has increased 77 and 55 times respectively in 1978-80 as compared to the base year of 1954-55. Whereas in the case of N it has increased only 35 times during the same period.

In intensively cropped district of Ludhiana (Punjab) which claims the highest average yield of wheat 82 to 99 per cent wheat fields are deficient in Zn and in Tamil Nadu in rice areas deficiency of Cu, Zn, Fe and Mn is 62, 35, 28 and 22 per cent respectively (Takkar and Randhawa, 1978). Over 130 m tons of food grains which we are producing today are removing about 18 million tons of nutrients as against 12 million tons of nutrients by about 100 m ton food grain in 1970-71. Through fertilizers we are adding only 5.3 million tons of nutrients and possibly 5 million tons from organic sources, still leaving a net balance or overdraft of 9.7 mil. tons on the soil bank. Can any bank remain solvent with such overdrafts? We also should not forget that annually we are losing 8.4 million tons of nutrients through soil erosion. I suggest we regularly prepare a health bulletin of our soils. For this purpose we should fix one hundred benchmark sites or reference points for every one million ha of net cropped area and get their soil samples analysed once in three years. It will help in preparing a health bulletin about the soil and monitoring the changes. Don't we prepare price index? Should not we undertake to prepare a health index of the soils of the country? It is high time that the National Bureau of Soil Survey and Land Use Planning, Soil Testing Labs and Fertilizer Association of India undertook this responsibility of regularly monitoring and preparing health bulletins of the soils.

Besides exhaustion of nutrients, the building up of some mineral elements such as Selenium, Flourine, Sodium, Lithium, and Copper in toxic amounts which can be injurious to the health of animals and human beings also needs to be monitored. Many of these mineral elements are building up in toxic amounts through irrigation, rise of salinity and alkali. Examples of these are reported from Punjab and Andhra Pradesh. The affluents of industry are also adding many toxic elements to soils and we should monitor them.

Another aspect which needs attention is the movement of minerals from soils into underground waters which may become a health hazard.

No doubt soil is a great sink, filter and detoxifier for many injurious chemicals but there are evidences of accretion of such injurious substances particularly nitrates into potable waters which can become health hazards. If in Punjab the nutrient consumption has gone up from less than 1 kg/ha in 1950 to more than 107 kg/ha in 1980, it may reach the similar levels as in the Netherlands or Japan by 2000 A.D. The consumption of pesticides will also increase simultaneously. This will lead to considerable rise in the amount of nitrates and injurious chemicals into ground waters. We realize, we can't avoid it, but we can certainly monitor and apply corrective checks wherever needed.

Introducing plants suited to the environments is a time honoured practice but tailoring plants to suit the special environment of particular nutrient deficiency or toxicity is a new development. Through conscious efforts of genetic engineering it is possible to use plant cultivars to make use of particular environments, instead of trying to change the environments. This is the principle of living with the nature instead of going against it. Brazil has achieved a wheat revolution by using aluminium tolerant variety of wheat in highly acid soils. Punjab is already cashing on IR-8 type rice varieties which are more tolerant of sodium in soil complex. Numerous possibilities exist but soil scientists and breeders should work together to exploit this potential.

Let me emphasize that there is no escape from greater use of fertilizers, manures and pesticides and irrigation water for obtaining higher production from less of land in future, but with constant vigilance we can face the challenges as they come. All our efforts should be directed to improving efficiency of these inputs so that their adverse effect on the environments are lessened. More recouse should also be made to exploiting the biological nitrogen fixation through Azolla, blue green algae, Rhizobial culture and Azospirillium bacteria etc. so as to lessen the need for addition of fertilizers which are the highest users of energy.

The crop residue and agricultural waste management has not received adequate attention in this country. They are most useful for improving soil health. It is frightening to see millions of tons of rice and what straw being burnt in the fields of Punjab and Haryana which besides depriving the soil of their beneficial effect is creating health hazards for the people. The scientists and technologists need to work together to use some of these residues for industrial purpose purpose and to use the rest in improving health of the soil. I believe the farmers have resorted to this practice in their situation of utter helplessness. Can something be done, is the question.

Urbanisation and Alienation of Prime Agricultural Lands for Non-farm Uses

No discussion of the soil problems will be complete without mention of the effect of increasing urbanisation on the soil and society. The rate at which urbanisation is going on and the need for land for civic uses increasing, is simply alarming. The axe is falling on the prime agricultural lands. With a rational land-use policy marginal lands could have been put to such non-agricultural uses. India has 18 million ha under non-agricultural uses and the rate of urbanisation may claim twice as much land for meeting the needs of the urban society, industry, highways, etc. by the end of the century. Unless a rational soils policy is adopted very important prime agricultural land will become victims of such non-agricultural uses. Besides this a huge amount of top soil is being used for brick making. I dont's wish to frighten you with the statistics but the fact remains that the demand is terrific. These excavations besides taking away the top soil also look like blisters on the surface of the land and cause serious interference in the drainage of the area. Time has come that we look into the possibility of using the soil from deeper layers instead of spreading in horizontal directions. Of course the question of cost-benefit-relationship will be the determining factor.

Time for a National Soils Policy

With today's technology we can certainly modify the soils to man's advantage. We can predict the changes and improvements if we know our soil well and quantify the input-output relationship. We could computerize irrigation schedules, fertilizer needs and likely behaviour of soils to management. I consider eighties a decade of integrated soil management system or better soil-water-plant management system in which all scientists, planners and farmers work together to save the soil, improve its health and make it produce to its potential capacity which is very high. I repeat, save the soil, save the nation. Unless we treat our soils well, time is not far off when we will say we dont have enough land for producing food, not enough fuel for cooking the food, not enough water for our farms and factories, not enough energy and not enough space to live in and clean atmosphere to breath in. We need national soils policy to save, improve and utilize our soils to their best capability and potential.

In conclusion, I may state we should know our soils, understand their problems, remove their constraints to production through use of technology and sound management system. We should recognize that man is the cause as well as the victim of the soil problems. Whether there are diasaters like floods or droughts, food famine, water, energy crisis or health hazards. The land resources are shrinking and quality of land deteriorating and we have no option but to produce more and more food, fibre, and fuel from less and less of land. We have the capacity to do but we need the will to do it and a national soils policy to accomplish it.

References

Abrol, I.P. and Bhumbla, D.R. 1971. Saline and alkali soils in India—their occurrence and management, World Soil Resources Report 41, FAO, Rome.

Dass, D.C. and Mukherjee, B.K. 1980. National perspective on soil and moisture cultivation, Agricultural Engineering Today: 4(3): pp. 11-17.

Kanwar, J.S. 1981. Problems and potentials of Vertisols and Alfisols—the two important soils of SAT—ICRISAT experience, International Symposium on distribution, characterization and utilization of problem soils, Tsukuba, Japan, October 19-26, 1981.

National Commission on Agriculture, 1976. Govt. of India, Ministry of Agriculture and Irrigation, New Delhi.

National Commission on Floods, 1980. Govt. of India, Ministry of Agriculture and Irrigation, New Delhi.

Patil, N.D., Umrani, N.K., Shende, S.A., Manke, B.S., Kale, S.P. and Shingte, A.K. 1981. Improved crop production technology for droughtprone areas of Maharashtra, Tech. Bull., Mahatma Phule Agricultural University, Dry Farming Research Station, Solapur, India.

Takkar, P.N. and Randhawa, N.S. 1978. Micronutrients in Indian Agriculture, Fertilizer News. 23 (8): pp. 3-26.

Tejwani, K.G. 1982. National Soil Policy for India, paper for 12th International Congress of Soil Science, New Delhi, 8-16 Feb., 1982.

Vohra, B.B. 1980. A charter for land, Sardar Patel Memorial Lectures, All India Radio, New Delhi, December 22-23, 1980.

Agriculture and Environment

H.K. JAIN*

No other human activity contributes as much to a healthy environment as agriculture does. The cultivated crop plants on a worldwide basis remove from the atmosphere millions of tonnes of carbon and release in the atmosphere corresponding quantities of oxygen. This is probably the best example of sound ecology in action. One might argue of course, that this function was being performed earlier by the forests and the natural grasslands, before these began to be cleared about 10,000 years ago to make room for agriculture. While no one questions the overwhelming role of forests in maintaining our environmental balance no one at the same time has ever questioned the need for agriculture. It is agriculture which made settled societies and our present civilisation possible. Our real concern today is not with regard to the relative importance of agriculture and forestry—both have their own value—the real concern is about the relative balance between forested and cultivated lands. This balance, unfortunately, has been greatly disturbed in recent years giving rise to a serious problem of management of our lands, soil and water.

Balance Between Forests and Agriculture

In India, today, we have nearly 145 million hectares of net cultivated land while the area under what may be described as reasonably well protected forests is believed to be about 35 million hectares. It is this imbalance, must be corrected through large-scale programmes of reforestation. Our present interest in agro-forestry and in energy plantations has its basis both in the current energy crisis as well as the paramount need to bring additional land under the trees. In order that we succeed in organising a massive programme of agro-forestry and energy plantations to augment our fuel resources, a number of important steps will have to be taken immediately. *One of these steps on the long-term basis is the setting up of strong departments of agro-forestry in our Agricultural Universities and some of the ICAR Institutes.* The primary responsibility for agro and social-forestry rests with the Forest Departments. However, these departments would require a great deal of research and development support in the identification of suitable tree species, in genetically improving them and in evolving a suitable package of practices for their successful cultivation. The departments of agro-forestry in the Agricultural Universities with their large groups of plant breeders, agronomists and other scientists are in a good position to take up responsibility of this kind. The agro-forestry department should provide the nucleus in these universities for research programmes of this kind to be organised.

---

*Director, Indian Agricultural Research Institute, New Delhi.

Another step which we should be taking in this direction relates to the planning of our irrigation command projects. Most of these projects involving the construction of dams, water storage reservoirs and other structures often lead to clearing of large tracts of forests. This is, perhaps, inevitable and it may be extremely difficult for a country like India not to develop its irrigation resources. However, a time has come when provision must be made in our planning of the irrigation command areas for a major component of agro-forestry plantations in the newly created command areas. At present, crop planning in these command areas is done primarily in respect of cereals, pulses, oilseeds, cotton and other cash crops. *In future we should be specifying parts of the irrigation command areas for agro-forestry plantations right from the beginning—both to create new sources of fuel and also to make up for the loss of the forest cover in the construction of dams and the storage reservoirs.*

Traditional vs. Modern Agriculture

When man first took to agriculture, there was very little fear of any adverse effects on environment. The traditional agriculture has been based largely on renewable resources of energy—solar energy, rainfall, crop and animal residues and waste products and the microbial activity, which decomposes them. Traditional agriculture uses very little of industrial inputs like the chemical fertilisers, pesticides and farm machines which can be a source of environmental pollution. The reason why we have not been able to live with this kind of traditional agriculture lies in man's present cultural and social evolution. Our present-day food needs which compel us to modernise our agriculture and make it so highly dependent on industrial inputs and large amounts of energy are a function of two major factors. First, the developing countries continue to maintain a high birth rate, which is no longer relevant to our species.

The high birth rate which we practise is more relevant to some of the species of animals whose young ones are more vulnerable. The snake, for example, has a very large number of off-springs of which only a few survive. Secondly, the western countries insist on the plant-animal-human food chain, even though there is a little evidence that it is nutritionally desirable. While our own consumption of food grains in India is about 200 kg in a year on a per capita basis, the corresponding consumption in U.S.A. is about one tonne. A large part of this quantity of foodgrains is first fed to animals for the production of meat and other animal products, and since animals are not good convertors of food grains into meat, the efficiency of this food chain is very low.

There is little evidence to suggest that the world's food needs in the years to come will decline. Indeed, they will continue to increase at a very rapid rate as the population pressures continue to develop and as more and more people in the western countries adopt this plant-animal-human food chain, as is now happening in the countries of Eastern Europe. India alone would require an additional quantity of 100 million tonnes of foodgrains by the end of this century.

In view of this fact, it is simply not possible for us to go back to traditional systems of agriculture as some people are suggesting. There are many people who criticise our "green revolution" and plead for a return to the traditional systems of farming. This option no longer exists. The traditional systems of farming with all their virtue are based fundamentally on low-yield technologies. Our greatest need today is to increase crop productivity per unit of land, and we must harness all the scientific resources which are available to achieve this result. When the environmentalist pleads for a return to traditional agriculture because of pollution and health hazards caused by chemical fertilisers, pesticides, machines and other components of modern farming, he is going to find few receptive people. *The answer to these problems of pollution and degradation of environment lies not in less science but in more science.*

The Present and the Future Technology of Agriculture

It is true that our present technology of agriculture, as it has evolved during the last 40 years in the world as a whole, is based on the use of large quantities of industrial inputs. The overwhelming consideration in evolving this technology which has proved highly productive and beneficial to mankind has been to increase productivity and not so much the efficiency of the production process. This technology has saved mankind from starvation and made complete sense during a period when fossil fuels were cheap, abundant and readily available and when energy was not a constraint. We, in India, had little choice but to adopt this technology in the face of serious food shortages in the early 1960s when we started to modernisation of our agriculture. However, the energy crisis of the early 1970s and an appreciation of the potential environmental hazards have made the agricultural scientists in more recent years to have second thoughts about the long-term value of our present techniques of agricultural production. This kind of analysis makes it clear that while we must make the fullest use of the present methods of crop production, which are basically sound, for another 10 to 15 years at least, a great deal can be done scientifically to make agriculture both highly productive and highly efficient, and above all, to make it increasingly dependent on renewable rather than non-renewable resources of energy. This would call for massive investments in organising new programmes of research but the pay off can be expected to be very great. One of the foremost scientific priorities both in the developing and the developed countries is to evolve in the next 15 years new technologies of crop production, which will make it possible for us to gradually reduce the use of chemical fertilisers, pesticides and farm machines without affecting crop productivity. Some of the foremost advances in science, specially in the domain of molecular biology, must be harnessed for this purpose. Today the benefits of this research have largely gone to biomedical fields. However, scientific advances which are now being made could also be harnessed for a more productive and more efficient agriculture in the years to come. Some of the problems which we face now and to which answers will be found through intensified research are considered here.

The Dangers of Genetic Uniformity of Crop Plants

Perhaps, the most important development in world agriculture in the last 15 years has been the introduction of a great deal of genetic uniformity in our crop plants with the development of high yielding varieties. Today a few of these high yielding varieties are beginning to replace a very large number of primitive cultivars, whose number runs into hundreds in many countries. In our own country, it has been estimated that we may be having as many as 30 thousand different varieties of rice selected by our farmers and scientists over the centuries. In the next 10 years, India may have no more than 300 rice varieties, and of these, 5 or 6 may be covering millions of hectares of land. Already, in the case of wheat, there are few varieties which are now grown widely not only in India but in neighbouring countries like Afghanisthan, Iran and all the way to Turkey. Genetic uniformity of this kind could be potentially dangerous as it could lead to build-up of diseases and pest epidemics in the years to come. The agricultural scientists in India have been conscious of this problem and they have, therefore, made major efforts to see that a large number of different varieties of crops are released and distributed in different parts of the country. It is this kind of genetic diversity which helps to erect genetic barriers against the spread of disease and we in India would continue to work for a varietal diversification of this kind. *Unfortunately, some recent developments in the area of seed production may run counter to this sound strategy for the control of diseases and pests. Many of the western countries in recent years have adopted plant breeders' rights for the varieties evolved largely by scientists of commercial organisations.* An important consequence of these patented varieties is that they are developed for very wide adaptability and are intended to cover very large areas. Also, the availability of seed patents is giving rise to the development of large multi-national companies which are beginning to take over the seed trade from smaller organisations. Many developing countries which depend on imported seed may soon find their choice limited to a few varieties, making their agriculture vulnerable to diseases and pest epidemics. *It is important in this context that countries like India intensify their seed production programmes; India has a responsibility for not only meeting its own seed needs, but it must also be able to meet the seed needs of some of the developing countries.* The developing countries must not make the mistake of making their agriculture genetically very uniform. This could spell disaster. *The crop planning programmes in a country must be decided not only on the basis of productivity goals, but also by keeping in view the threat of disease and pest epidemics. Varietal diversification provides the only answer to this problem.*

Chemical Fertilisers

In countries like India, the largest component investment in a modern agricultural production technology is in the form of chemical fertilisers. India's progress in producing its own chemical fertilisers has been remarkable by any standards. *In the last 20 years, India has become the fourth largest producer and consumer of fertiliser nitrogen in the world as a whole.* While this is an achievement of which we can all be proud, the fact remains that even today our per hectare use of fertilisers—32 kg per hectare of our gross cropped area—is one of the lowest in the world, with countries like Japan using more than 200 kg of plant nutrients per hectare. It is clear that we shall have to import increasingly large quantities of fertilisers in the next 20 years if our average crop yields are to be increased significantly. The gap between production and consumption of fertiliser nitrogen on the basis of present trend is expected to be two million tonnes in 1990, after which it may steadily increase. The gap, of course, would be much more if we were to follow countries like Japan. Fortunately, recent advances in scientific reseach offer possibilities of a new kind of technology where the fertiliser needs will be increasingly met by bacteria and other micro-organisms in the soil. One of the major concerns of agricultural scientists in the world as a whole today is to make crop plants partly independent of industrially produced nitrogen. This may be possible through a greater exploitation of biological fixation of nitrogen, a process which is already known in pulses. *The paramount need is to see that new species of bacteria and other micro-organisms are found or genetically manipulated to fix nitrogen in the case of cereals and other crops also.* Already, scientists have discovered several of these species and there are possibilities of a major scientific advance in this field. India's investment in fertiliser production is nearly 30,000 crores of rupees at present. With a much smaller investment in microbiological research, it may become possible in the next 10-15 years to produce significant amounts of fertiliser nitrogen through the renewable source of microbial activity. The Cancun declaration on food has to be translated in the form of international research programmes of this kind to become meaningful in the years to come.

Irrigation

No other country in the entire history of agriculture has probably made greater investments in the development of irrigation in such a short period of time as India has in the last 30 years. Our net irrigated area increased from nearly 20 million hectares in 1950-51 to nearly 40 million hectares in 1980-81. The gross irrigated area increased from 22 million hectares to 50 million hectares over this period. Also, India has some of the world's most ambitious programmes of irrigation in the next 20 years when the gross irrigated area will increase to 113 million hectares. No other country has invested so much in irrigation in such a short period of time. It is known, however, that we have yet to get corresponding returns in terms of increased food production from this resource. The cropping intensity during this period, for example, has seen only a limited increase. The intensity of cropping in the irrigated aseas increased from 108 per cent to nearly 125 per cent during this 30 year period. *A more efficient use of irrigation water through reduction in the great losses which occur at present in the process of conveyance, distribution and on-farm irrigation would go a long way in increasing the intensity of our crop production.* Also, the development of irrigation has been associated in many cases with serious problems of soil salinity, soil erosion and water logging. The losses because of these problems in some of the irrigation command areas are known to be relatively high. The major problem is one of drainage of the excess water. *Fortunately, the country is now becoming conscious of these sources of losses and degradation of* *land in our irrigation command areas and the next 20 years, which may see an investment of as much as 50,000 crores of rupees in irrigation, should see a greater integration of efforts in the development of irrigation and drainage. There is little doubt that the future production and productivity of our agriculture will depend to a large-extent on a more efficient management of these irrigation command areas.* There is tremendous scope to increase the intensity of cropping and a more efficient use of water through proper crop planning and other needs.

Use of Pesticides in Our Agriculture

India's failure to increase significantly its production of pulses and oilseeds partly arises from our failure to use pest control measures, which are considered to be very important for these crops. Environmentally conscious countries like U.S.A. use as much as 6,000 gm of pesticides per hectare and Japan uses more than 10,000 gm per hectare. In India our present consumption is about 500 gm per hectare. While we shall have to provide greater plant protection support to our crop plants in the years to come through the use of pesticides, the world as a whole must evolve new strategies for the control of insect pests. *Recent researches both in India and abroad have shown the possibility of controlling pests through an integrated approach in which the use of pesticides forms one of the components of the total strategy.* One such approach is to place greater lands on resistant varieties. The second is to use biological control measures so that parasites are released in the fields which will attack and kill insect pests damaging the crop. This is being done for a number of crops. A third strategy is to monitor the insect build-up and to use the pesticide sprays only when the population has reached a relatively high level. The use of sex hormones to monitor insect population in the fields opens up new possibilities in this direction. Indian scientists have also evolved in recent years scientific inter-cropping patterns so that two crops are grown in the field at the same time without reduction in yield. This kind of genetic diversity provides a natural barrier against the build-up of both diseases and pests. It can be expected that in the next 15 years integrated pest management may lead to a significant reduction in the use of pesticides.

These are but a few of the approaches which are now being explored. These are the new directions which provide answers to the problem of combining high levels of production with a high degree of efficiency of the production pregrammes, keeping the environment at the same time free from pollution. *Agriculture by the end of the century would certainly be different from what it is today. It will not only be more productive but will also be more efficient deriving much greater* *support from the renewable resources of energy. While we must work towards this goal, it will be a serious mistake to slow down our present programmes of increased production of chemical fertilisers and other industrial inputs. They will continue to have a most important role in the next 15 years when the population pressures will be much greater. In the name of a long-term strategy we must not dilute the short-term objectives and approaches.*

Statement on International Conference on Environmental Education

PETER S. THACHER*

Mr. Chairman,

On behalf of Dr. Tolba, Executive Director of the United Nations Environment Programme, I wish to express our deep gratitude to the Indian Environment Society and all other national and international sponsors for having organized this important International Conference on Environmental Education. As an educator as well as an environmentalist, Dr. Tolba particularly regrets his inability to be with you and to join this important dialogue and exchange of experience.

As his Deputy, and as a former Programme Director at the UN Conference on the Human Environment in Stockholm, close to ten years ago, I can share with you the conclusion of thousands of discussions I have been privy to over the decade of the 70s on the question of how to accomplish the objective laid down at Stocholm; "to protect and enhance the quality of the human environment for present and future generations".

Out of a growing concern for the inter-relationships between population, resources, environment and development, concepts are developing by which to achieve sustainable development, for rational use of natural resources, to satisfy basic human needs. The World Conservation Strategy has been articulated and accepted by governments around the globe, along with methods by which to incorporate environmental considerations alongside economic and other factors in planning and decision-making, particularly at the national level. A New International Economic Order is being elaborated at the international level as a focus of world community attention in the decades ahead. Major international programmes are underway to improve production and distribution of food, health, energy, water and other ingredients for life on this planet.

---

*Deputy Executive Director, United Nations Environment Programme, Nairobi, Kenya.

The key to the achievement of all this, the one-word conclusion of the search for the strategic area in which efforts must be expanded is, of course, education. And the objective is to increase understanding and environmental awareness by *all* the citizens of this—our Only One Earth.

* * *

In his succinct opening statement at the first Intergovernmental Conference on Environmental Education, organized by UNESCO and UNEP at Tbilisi, USSR, on 14 October 1977, Dr. Tolba highlighted the importance of environmental education in these terms:

> "... in the long run nothing significant will happen to reduce local and international threats to the environment unless widespread public awareness is aroused concerning the essential links between environmental quality and the continued satisfaction of human needs."

> Moreover,

> "human needs and aspirations the world over can only be satisfied as environmental awareness leads to appropriate action at all levels of society from the smallest local communities to the whole community of nations. Appropriate action requires a solid base of sound information and technical skills. But action also depends upon motivation, which depends upon widespread understanding and that, in turn, depends upon education."

> The Executive Director concluded that what was required is:

> "continuing educative action so that all strata of society everywhere become aware of their responsibilities and willing to do what they can to help."

The second decade of the UN Environment Programme will be launched next May at our Headquarters in Nairobi, and it is therefore appropriate to take stock now and apply lessons learned in the first decade so that the next generation—the youth of today—will be made more aware, and more responsible. We view this Conference as an opportunity to learn from you, the practitioners of environmental education at the national level, so that at the international level we may better serve you and others engaged in creating public awareness and understanding.

* * *

Mr. Chairman, I submit that in general terms we are today at a phase where considerable progress has been made in developing the tools necessary to increase public awareness, and the immediate needs are now to apply the knowledge already gained in environmental education, and, at the same time, to broaden the effort to enlist active participation by allies, especially in non-governmental organizations and mass media.

* * *

The agenda of this International Conference shows your determination to apply the skills and techniques that have been developed in the field of environmental education. The Declaration adoped four years ago at the Tbilisi Conference laid down strong guidelines in terms of a continuing process addressed to all ages, a "comprehensive lifelong education" with a "holistic approach" acknowledging that "natural and man-made environment are profoundly inter-dependent" and revealing "the enduring continuity which links the acts of today to the consequences for tomorrow". The Declaration also explicitly recognized the great responsibility for mass media as a vehicle in creating awareness and better understanding of environmental problems, an aspect I will address shortly.

In the decade since the Stockholm Environment Conference, and the four years since Tbilisi, there have been significant advances in understanding the relationships between education, environment and development in all their aspects. The concept has been advanced that environmental education is a requisite for new motivations, a re-orientation of attitudes and thinking towards a worldwide understanding of environmental balance necessary for the well-being of mankind and for the preservation of natural resources, including innumerable species of animals, plants and micro-organisms on which all life in the biosphere depends, including human life. The creation of a new awareness and perception, new approaches, the acquisition of fresh insights, and the development of new skills in a broader perspective are educational tasks. Furthermore, since meaningful environmental action depends upon a well-informed public, environmental education becomes the lynch-pin of orderly and sound development. What must be done, therefore, is to strengthen the role of education in confronting problems of the human environment.

At the *international* level we see many encouraging signs, especially in co-operation between states under the leadership of UNESCO in the International Environmental Education Programme (IEEP), and in associated programmes such as the International Labour Office's worker's education programme, with which we, in UNEP, are also closely associated.

Together with UNESCO, ILO and many other organizations in the UN System, we will present to our Governing Council at its Tenth Session in Nairobi next May, a System-wide Medium Term Environment Programme (SWMTEP) for the period 1984-89 setting forth objectives for the entire programme, including environmental education, for the whole UN Sytem. The results of this meeting in New Delhi can help us to be more precise about the actions needed.

Although we face, as you do, severe financial restraints, I am confident of the political support required to mobilize necessary resources, especially here in the region of Asia. Let me cite one recent event.

One month ago at the General Assembly now meeting at UN Headquarters in New York, the Government of the People's Republic of China circulated the text of the Beijing Declaration on Population and Development of 30 October 1981 setting forth the agreed conclusions of parliamentarians from 19 Asian countries who attended the first Asian Conference on Population and Development. After reaffirming the objectives and goals of the Colombo Declaration on Population and Development, and the Kuala Lumpur Declaration on Resources, Population and Development, these parliamentarians identified common concerns facing the countries in Asia in terms of the effects of the imbalance between population and resources which cause deforestation, soil erosion, and other ecological changes leading to a deterioration of the natural environment. The Conference approved a number of objectives calling for more effective utilization and management of resources by the integration of population, resources and environment in the development process.

The first action call of the Conference is for the parliaments of the Asian countries to "increase the awareness and promote greater understanding of the inter relationships between population and development amongst parliamentarians." The Conference called on the governments of the Asian countries to "promote basic and vocational education and training, to ensure continuing education, to integrate population education with formal and non-formal education, systems as a preparation for youth to become responsible citizens for their participation in development and population programmes." And it is encouraging to see that non-governmental organizations figure prominently in this declaration along side the press and other media who are requested "to provide positive coverage of population and development issues so as to increase public awareness and understanding of these matters."

The parliamentarians at this conference approved an explicit commitment that as *legislators* they "will stimulate the interest and create awareness and understanding" of these inter-relationships; as *community leaders* they "will generate public support, participation and involvement to achieve optimum use of resources in the implementation of programmes to improve the socio-economic level of the people"; and as *representatives* of the people they dedicated themselves "to functioning as the channel of communication for the articulation of the people's needs and problems as well as to ensure and to be involved in the assessment of the implementation of policies and programmes and to bring about the necessary adjustments and improvements".

We were proud to see that a sister organization, the UN Fund for Population Activities, was intimately involved with the Government of the People's Republic of China in the preparation of this historic Conference. As environmentalists and educators we can be encouraged by the noteworthy agreements that are recorded in this declaration.

* * *

I have talked of action at the international and regional levels, but I believe you will agree that environmental problems are first recognized as such by individuals at the community level, that is, in terms of a harmful impact on those with whom the individual has close ties of affection and co-operation.

Historically, it is instructive to note that pollution, a significant part of environmental concern, is first perceived as a problem in the working environment where high levels of concentration are seen to be linked to after-effects in the form of deterioration of the health of the worker.

Similarly, villages and small communities are the first to suffer the impacts of environmental degradation in the form of soil erosion and infant mortality from impure water, and environmental education at that level can help the community to identify the tree cutting or bad sanitary practices which cause the problem, and thereby lay a basis for rational community action to redress the trend. Many such problems will be beyond the capacity of the community to solve, and so co-operation must be expanded if it is to be effective.

Of course, it is true that the problem of soil erosion, like that of unsafe drinking water, are global problems in which many international organizations, especially in the UN system, have a major role to play to help governments cope with such problems effectively. But these efforts, at the global level, and the resources devoted to them, will remain inconsequential if action fails at the community level; it is here that the effort to build public understanding and awareness must be concentrated. That is why we salute you for coming together to exchange experience and perfect the use of tools that are available, and to identify the specific needs of your national and community programmes of environmental education.

* * *

Mr. Chairman, at Tbilisi Dr. Tolba saw environmental education as a basis for motivation.

Clearly, it is not enough merely to understand the problem. With understanding there comes a responsibility towards ones neighbours and towards future generations to assess the consequences of current actions, or inactions, and to protect the well being of others.

Education alone can lay the basis, but more is needed to stimuiate motivation. This is why we welcome the attention your agenda gives to the roles of policy makers, political leaders and, especially, mass media.

Having identified the educational tools by which to make environmental education more effective, and after determining the strategies at community, national, regional and international levels for intensive effort, we must go on to enlist the active participation of groups which are not usually considered members of the educational community. These will often be non-governmental groups of people who come together out of concern about a particular environmental or conservation problem; to protect or plant trees; to protect endangered species or places; or simply to discuss the trade-offs in local projects.

I suggest that one such group whose help we need is industry. Industry possesses a significant amount of experience and information on scientific and technological problems including that pertaining to the environment. It would be useful to elicit the collaboration of industry in curricula development as well as in other educational activities. Students, particularly those at university and technical colleges, will be made more aware of practical and real life problems, while industry personnel will have the opportunity to keep their knowledge current, ideas tested, and make direct contributions to the education and training of human resources. This form of collaboration will also promote better understanding on topical and contentious issues and hence alleviate confrontation. As a result of our collaboration with industry at the international level a number of documents have been published and we would be pleased to make them available to you. As an example, I have here a list of some of the publications of UNEP's Industry and Environment Office, which I will leave with the Chairman. And tomorrow you will be addressed by Dr. Ashok Khosla, Director of UNEP's INFOTERRA, who will provide additional insight on our ability to provide information support.

The mass media are another key ally in stimulating public awareness and motivation. Naturally their effectiveness may be dissipated if the information they convey is unfounded, or overly-simplistic, or concerned only with problems, rather than solutions. I am most encouraged to see the attention given to mass media on your programme.

At the international level we in UNEP distribute information intended for use by media which is environmentally educational on all aspects of the System-wide Programme. The best known element is our production each year for World Environment Day of a substantial press kit based on our annual Report on the State of the Environment. Through co-operative arrangements in each region we seek to encourage local adaptations on the issues raised in these reports in order to increase their relevancy to local perceptions.

1982 being the tenth year after the UN Environment Conference, Dr. Tolba will produce a comprehensive Report on the State of the Environment 1972-1982, to assess the state of the world environment in the decade after the Stockholm Conference as a basis for decisions on the new directions which our programme will take in its second decade.

In the months ahead we will be trying to ensure that this material reaches those who need it most, and no one in this region is better qualified to help us than you. In many countries the mechanisms for distribution are well-developed, the media well-informed, and public-interest groups abound. In your countries the situation calls for greater efforts and I know we can count on you to help carry the message.

* * *

To sum up, Mr. Chairman, in the ten years since Stockholm the means by which to preserve and enhance the quality of the environment for present and future generations have been perfected, knowledge and tools are at hand, political leaders in all parts of the world today look upon environmental needs in the same terms as did Prime Minister Indira Gandhi when she addressed the Stockholm Conference, as an "inadequacy of development"; the stage has been set for action.

The key resource, as always, is the human resource, and the greatest obstacle holding up action today is a lack of understanding and awareness at the level of the individual and his community. The outcome in terms of human dignity and sustainable development depends on how well you can apply your skills for environmental education, and encourage others to follow your example.

The Role of the Mass Media in Environmental Education

H.Y. SHARADA PRASAD*

That quip about the medium being the message was meant by McLuhan as a put down on the entertainment habits of affluent societies. But it applies, in a different sense, to unaffluent societies as well. Because of novelty, T.V. or films in these societies are interesting objects in themselves, no matter how dull or undistinguished the fare they serve.

Any serious discussion on the media, however, should be about the message its meaning and purpose Purpose takes us to the state of a particular society. Communication depends not merely on the distinctive technological capabilities of a given medium but on the overall socio-economic situation of a society. The first will determine only the *reach*. But *impact* is a much more complex process.

One other preliminary point needs to be made. Affluent societies are roughly alike in their media use. But between one backward country and another there is great variation. This is not to deny there are similarities. To begin with, the reach of the media is very limited in all the developing countries. (Media spread is itself a parameter of development.) Purchasing power is low and the technological infrastructure inadequate. But if you will permit me, I shall today be parochial and speak only about India and not attempt a second-hand summing up of the communication scene in other countries.

India has nearly 140 million families. But the number of radio sets is around 25 million and that of the television boxes probably a little more than a million. Even though the first newspaper was published 200 years ago, not a single journal has crossed the million mark in circulation. The cumulative sale of newspapers is still limited. Listen to what one of the oldest and largest newspapers of this country wrote only a week ago:

---

*Information Adviser to the Prime Minister, Government of India, New Delhi.

> "In India barely 30 per cent of the people are literate. A vast majority of them do not read any newspaper or journal. The total circulation is around 10 million in a population of 680 million—less than 1.5 per one hundred. Newspapers are not run from one centre and follow different editorial lines. A majority of their readers do not read the editorials. In the circumstances, newspaper editors cannot possibly suffer from the illusion that they can influence the outcome of elections even in big cities like Bombay, Delhi, Madras and Calcutta."
>
> (From editorial entitled "Whose Credibility?" in the *Times of India*, 11 December 1981).

Sales figures do not by themselves tell the whole story. In India each paper is read, each radio set listened to and each television set seen by more persons than in affluent countries. Even so the truth is that the media in our country are not and cannot be called *mass* media.

Are the media then irrelevant? The answer is an emphatic no. The explanation of this seeming paradox between reach and impact is that even though the media may not reach the mass of the people directly, they reach them at second and third remove.

Ours is still an oral society—where information (and opinion, even more) spreads through personal encounter and word of mouth. The oral communicator is more convincing because he is more real and questions can be put to him and doubts posed and removed. The audio-visual media, being impersonal, have limitations for persons bred in the oral tradition. This has to be counterposed against the novelty factor I mentioned earlier. However, the printed word, the taped message and the filmed picture remain a major source of knowledge and argument for the opinion-maker and the human vehicle of information, the communicator.

The media provide news and views and talking points for the community leaders or opinion makers—who in turn influence the beliefs and attitudes of others. Also, scarcity value, the very fact that a radio set or a copy of a newspaper *costs* more in relative terms; invests them with greater authority. The question is: how can we use the personal communicators and the media to change the attitudes, to advance new perceptions and concepts? More concretely, how can we persuade the people of India to have fewer children, not to cut trees, not to urinate or spit in public places, not to let wastes flow into tanks and rivers, and to be careful about the water they drink.

We learnt as schoolchildren that a body will remain at rest or will continue to move in a particular direction at the same velocity unless an external force acts on it. There is a similar law of inertia in beliefs and attitudes. The external forces that can bring about changes are several. One is gain—or greed. Another is shame or censure. A third is fear of pain. (It has been said that the Church would change its attitude towards family planning if bishops could become pregnant.) A fourth is praise or the desire to be considered modern.

But first let us deal with the prevalent environment on the matter of environment. The fact is that environment-consciousness in our country (except at the very highest level) is not very notable among those whose actions have much to do with environment. I am not referring to the masses but to officials and legislators and the so-called elite. Let me narrate, with your permission, two personal (and recent) experiences.

A few days ago a house in my neighbourhood fell vacant and in came a new tenant. The first thing he did was to have a beautiful 50-year-old neem cut down, along with some peach trees. I suppose it can be argued that every person has the right to decide how to wear his or her hair and, likewise, what trees to have around his or her house. But my neighbour's reason was not aesthetics but utility; I am told that a marriage is to take place soon in his house and he wanted space for holding a reception. So trees which took years to grow were cut down for a single evening's function. I have also a suspicion that his profession was something to do with his outlook—for he is a police officer.

But my other experience shows that persons in the gentler professions have not proved more humane—as I shall narrate. A major monument—a sculptural ensemble—is coming up in Delhi. By virtue of my official duties, I was asked to ensure that there were no delays in its completion. When I went to the site a few days ago, what did I find? Apart from the shrubs which had to be cleared to locate the monument, several trees in the vicinity had been uprooted. When I asked what harm the poor dears had done, the plea put forward was that the monument should have the benefit of a clear skyline. One tree which was almost 50 metres away and in no way obstructed anyone's view, had been felled just a day earlier. I found that the engineer in charge of the place did not feel any remorse. He said that the sculptor associated with the monument felt that the trees did not go well with the sculpture. A senior architect, who is one of the custodians of Delhi's urban environment, was with me during the visit, but I did not find any annoyance on his face.

This is our main problem. If a senior government official, an engineer, an artist and an architect have no feel for the elementary laws of the environment, if they are no respecters of the simple right of a harmless tree to stand and live, how can we take environment-consciousness to the hundreds of thousands of our illiterate people and teach them that they should let trees be? They, the rural and urban poor, at least have the irrefutable argument of need on their side. If they did not collect firewood they cannot have their 'roti' or their pot of rice. In the South one finds that trees on either side of national and state highways have for miles been stripped of their bark; and anything that can be fed to cows and goats is cut. The answer to this problem is not more education or media persuasion but a more basic one—that scientists and administrators must provide alternative and inexpensive domestic fuel. It is only when that is provided that that foraging for fuelwood can be checked.

I wish to reiterate the fact that the basic problem in our country in the matter of environment is that those who should be on the side of conservation—the decision-makers and executives (with some eminent and well-known exceptions)—are not even aware of the problem. In this conservation is different from family planning. There the political elite at least pays lip-service to the objective. The masses have not become full participants mainly because the administration and the health network are not yet able to provide the means. But in the matter of environment even the basic commitment is absent. The decision-makers and executives still remain developers rather than conservers.

Until the conservers came along, the developers (or exploiters) had it all their way. Today we find in many countries a counterattack on the conservationists. When private profit or immediate gain for a region is at stake, the conserver loses out. After all he stands for status quo. Even though he is moved by concern for the future, he is regarded as an opponent of development. In our country there has been a loud controversy over the Silent Valley. A very large proportion of administrators, politicians and scientists of Kerala seemed to favour location of the power project in that Valley. The conservationists were accused of being subversives in foreign pay wanting to undermine the nation's economic strength. Some politicians in the United States, similarly, have accused conservation lobbies of being unAmerican.

Environmental education is a long haul. It faces the same resistance as the cause of workers' rights did in the last century and women's political rights in our times. What most employees today accept as a legitimate claim, their grandfathers would not have. The robber barons had little concern for either the workers or the natural resources they exploited in their own countries or in colonies. Nature seems to be the last colony of man.

But things did change when it dawned on the entrepreneurs and exploiters that immediate advantage was the enemy of long-term profit. Workers' movements, the toil of reformers, and the entire educational process helped to secure wide acceptance of industrial safety, humane practices nnd employers' responsibilities. The cleaning up of the environs of industrial establishments was an offshoot of this new awareness – which later found organised expression in the form of laws and municipal rules. Rivers which had become sewers became rivers again.

Many developing countries are at the phase of socio-economic development where quick gain and benefit are the ruling mottoes Municipalities are converting wood-lots and orchards into building sites—ostensibly to increase their revenues but more so because councillors want building sites for themselves and for their relations and friends. Contractors' lobbies are able so often to influence major decisions.

All this makes the educative effort so much harder and so much more necessary—both curricular education in the schools and continuing education through the media.

Your Conference would have discussed various aspects of this problem. Programmes for children and youth and farmers and neoliterates are important. But my personal view is that the starting point should be the education of engineers and of administrators, councillors and legislators. (Let me hasten to add that I have personally known engineers of vision. I am not blaming any class as such. I am mentioning engineers because they are directly concerned with changing the face of the country.)

It is a fashion to speak disparagingly of politicians. But they are any day more sensitive to public opinion than officials and engineers are. The fact that public opinion determines politicians' lives is what gives the crusading editor and the media their cutting edge. The conservation campaigners and enlightened specialists will find the media receptive to their concerns. We know from history how minorities of one have often prevailed over majorities of many. The media act as the carriers of the passion of dedicated individuals. And one cannot forget that some of these dedicated individuals are in politics. Many legislators have been champions of great causes.

These days education technologists spend a great deal of time discussing and devising audio-visual formats. There is no doubt that a good tape and a well-made filmstrip or film makes a big difference to the classroom lesson. But in our country and other developing countries we have the question of costs and delivery. An audiovisual programme takes money to make. Programme-making talent is not too plentiful. Apart from these production constraints, we have the question of how to take the programme to all the schools, especially with our multiplicity of languages and dialects. None can dispute that television is a highly potent educational medium even when it is not imaginatively handled. But in a country where half the total number of 600,000 schools do not have drinking water in schools—no earthen pots, let alone tap—can you install television sets or slide projectors even if good programmes are made?

At the stage at which we are, the media can be more effectively used in educating the teachers, rather than reaching the pupils. The focus of printed and audio-visual programmes of conservation education should be the teacher, the college student, the progressive farmer, the extension worker, the panchayat chairman, the city ward boss. They (the programmes) should use the techniques of popular science to coax some of the viewers into new courses of action and shame others to curb personal and collective greed. Simultaneously work must continue—using pedagogic and adult education insights—on how to speak to the masses when the media manage to reach them.

International Conference on Environmental Education

J. MARTON-LEFEVRE*

Mr. Chairman, Ladies and Gentlemen, distinguished participants, it is a great honour and pleasure for me to attend and participate in this important Conference on Environmental Education. I do so wearing several hats: one is that of the Deputy Chairman of the Commission on Education of the International Union for the Conservation of Nature and Natural Resources (IUCN), another is as the Assistant Executive Secretary of the International Council of Scientific Unions (ICSU), and the third as an individual, long interested and involved in international environmental education issues. I shall not dwell on the latter and only hope that during my participation in this Conference, I shall have a chance for much fruitful exchange of information and ideas with many of you.

I would, however, like to tell you about both international non-governmental organizations I am involved in and represent here. First of all, IUCN: the Chairman of the Commission on Education, Dr. Albert Baez, asked me to convey to you his greetings and his wishes for a successful Conference. He would have been very pleased to be here himself had this been possible, and I have assured him that I shall keep him and the members of the Education Commission fully informed of your deliberations.

Just a brief word about IUCN itself: IUCN was established in 1948 to promote scientifically-based action directed towards the protection and sustainable use of living material resources. It is an independent, international non-governmental organization with 470 members from 109 nations, including 54 sovereign states, 116 governmental agencies and over 300 non-governmental organizations. IUCN has six Commissions: Ecology, Education, Environmental Planning, Species Survival, Environmental Policy, Law and Administration and National Parks and

---

Deputy Chairman, IUCN Commission on Education and Assistant Executive Secretary, ICSU Paris, France.

Protected Areas, each comprising a body of volunteer experts who make major contributions to the development and execution of the IUCN programme. Together they constitute a global network of over 1,500 scientists and professionals. IUCN carries out a substantial programme of monitoring, planning, promoting and offering assistance to governments, inter-governmental bodies and NGOs. This programme is based upon the authoritative information and advice provided by IUCN members and Commissions with whom they and the IUCN Secretariate (located near Geneva in Switzerland) are in contact[1].

The Commission on Education of IUCN was founded in 1949, a year after the founding of the Union itself. The first Chairman of the Commission was Dr. I.N. Gabrielson of the United States, President of the Wildlife Management Institute and a founding Member of IUCN. Dr. Gabrielson was succeeded in 1960 by Dr. L.K. Shaposhnikov, Director of the U.S.S.R. Central Laboratory for Nature Conservation. Dr. A.V. Baez, physicist, science educator and formerly Director of Unesco's Division of Science Teaching and Chairman of ICSU's Committee on the Teaching of Science, became Commission Chairman in 1979.

During the early years of the Commission's existence, activities centered around the elaboration of definitions and of resolutions for all different fields of environmental education and the preparation of educational materials for schools and youth groups, such as illustrated brochures, film strips and a guide to conservation. The International Youth Federation for Conservation (IYF) was founded during this period and continues to this day to carry out training activities involving youth from all the regions of the world.

After 1960 the Commission began to encourage the creation of regional committees and the organization of meetings and workshops. A number of these early meetings were very important in laying the foundation of international environmental education activities. I shall only mention a few of these as examples of the variety of activities undertaken: the Symposium on Conservation Education at University Level, held in Lucerne in 1966; the International Working Meeting on Environmental Education in the School Curriculum, held in Nevada in 1970; the First European Working Conference on Environmental Conservation Education in Ruschlikon, Switzerland in 1979; and the Workshop on Environmental Education Methodology in East Africa, held in Mombasa in 1974. Since 1975 the Commission has co-operated fully with the Unesco-UNEP Environmental Education Programme, created that year, and was therefore closely involved in the International Workshop on Environmental Education held in Belgrade in 1975; as well as in the Intergovernmental Conference on Environmental Education held in Tbilisi, U.S.S.R. in 1977.

---

[1] **IUCN Conservation Achievements, 1980, page i.**

As a result of a recommendation of IUCN's 14th General Assembly held in 1978, highlighting the paramount importance of education in the conservation of nature and natural resources, IUCN created a Task Force to re-examine the goals and objectives of the Commission on Education. Following the recommendations of this Task Force and within the framework of the World Conservation Strategy, published in 1980, the newly elected officers and members of the Commission on Education embarked upon a plan for restructuring the programme of activities of the Commission.

The revised overall goal for the Commission's activities is to "stimulate the general public and selected groups, through education, to act for environmental improvement by generating an understanding of and a commitment to environmental ethics and objectives". In order to achieve such an ambitious goal, the Commission has set the following objectives:

—To promote formal and non-formal education related to the environment by implementing the World Conservation Strategy:

* by promoting the inclusion of environmental objectives within ongoing educational programmes and projects; and developing new projects;

* by encouraging public participation in environmental issues;

* by facilitating communication within the professional community concerned with the basic aims of IUCN.

—To train specialists involved in management and decision-making related to conservation:

* by promoting and developing training programmes for natural resources managers;

* by supporting the development of a network of wildlife and parks training centres for developing countries;

* by assisting government departments to meet training needs.

—To incorporate education components in IUCN undertaking;

- by monitoring and evaluating progress of education components in IUCN and WWF projects;
- by preparing education materials for inclusion in such projects;
- by preparing and disseminating public information materials for the strengthening of international conventions administered or supported by IUCN and WWF[2].

This last objective is extremely important as the Commission feels that one of its major functions is to be in constant contact with all the other IUCN undertakings in order to assure that the education and training component is there and that it is properly implemented.

Since mid-1980 the reconstructed Commission has therefore been working towards the achievement of these objectives with the technical and financial support of the United Nations Environment Programme (UNEP), the World Wildlife Fund, the Ciba-Geigy Foundation, and the Dutch Ministry of Cultural Affaris, Recreation and Social Welfare.

During this time the membership of the Commission has increased from 50 persons in 27 countries to 195 members from 66 countries. Members come from all the world regions and their expertise covers the entire broad spectrum of environmental education, from teachers in the formal school system at all its levels, to museum directors, science writers, curriculum developers, youth leaders and so on. These persons form a valuable international network for the exchange of ideas and information and for the carrying out and monitoring of the Commission's projects.

The Commission has also encouraged decentralization through the formation of regional or national committees. Two regional committees in existence since the early days the Commission have continued to be active: the North-West Europe and the East Europe Committees. In addition, committees have been or are being established in Argentina, Australia, Canada, China, Czechoslovakia, India, Pakistan, Poland and the United States.

The Commission encourages the establishment of such regional and national committees in order to assure that its projects are carried out in accordance with the needs and priorities of the local populations toward which they are targeted. There is, however, a constant flow of information between these regional or national committees and the Secretariat and Officers of the Commission in order to ensure that all the Commission activities remain coherent and form a part of its overall programme.

---

[2] A Conservation Programme for Sustainable Development 1981-1983, pp. 18-19.

The Commission has met twice since its re-constitution: in Vadstena, Sweden, in August 1980, and in New Zealand in October of this year. At both of these meetings Commission members stressed the need for the preparation of concrete environmental education projects which meet local needs and which could also be adapted for use by a wide range of environmental educators all over the world.

Before describing the specific projects of the Commission, I should like to say a few words about the World Conservation Strategy. This document was published in March 1980 by IUCN in co-operation with UNEP and the World Wildlife Fund. The Strategy is intended to stimulate a more focussed approach to the management of living resources and to provide policy guidance on how this can be carried out by three main concepts: governmental policy-makers and their advisers; conservationists and others directly concerned with living resources; and development practitioners including development agencies, industry, commerce and trade unions.

The aim of the World Conservation Strategy is to achieve three main objectives of living resource conservation:

—to maintain essential ecological processes and life-supporting systems;

—to preserve genetic diversity; and

—to ensure the sustainable utilization of species and ecosystems.

Two of the Strategy's twenty sections deal specifically with questions related to education: Chapter 12 is entitled "Improving the capacity to manage: training and research" and points to the lack of trained personnel or adequate research programmes as major constraints for the implementation of conservation measures. This section recommends that each country review its training capacities, strengthen these as appropriate and place living resource research high in national scientific and research programmes.

Section 13 of the Strategy is entitled "Building support for conservation: participation and education". This section states that "ultimately the behaviour of entire societies towards the biosphere must be transformed if the achievement of consevation objectives is to be assured", and sets as a high priority task for environmental education, the fostering of a new environmental ethic which would encourage human beings to live harmoniously with the natural world on which they depend[3].

I have given this rather detailed presentation of the Strategy only as an illustration of the principal point of reference upon which all of IUCN's and the Commission on Education's efforts are focussed.

Now to return to the concrete projects which the Commission has or is carrying out. These include a multi-media pack on the World Conservation Strategy to be used by teachers of 10-12 year olds, either in or out of school. I have brought this with me and would be happy to show it to you at the end of my presentation.

Other projects are:

—a directory of existing institutions worldwide providing training for park managers and wildlife personnel;

—an information booklet on the World Conservation Strategy, principally aimed at decision-makers and educators;

—a handbook on out-of-school environmental education activities for 10 to 16 year olds;

—the development of a model university course on the World Conservation Strategy;

—an illustrated glossary on environmental education topics with reference to the World Conservation Strategy;

—a training handbook for environmental administrators;

—reference cards of environmental education terms in French; and

—a guidebook for 16-20 year olds on how to organize widlife clubs.

In addition to these specific projects, the Commission has undertaken to carry out a survey of the activities and interests of its members in order to establish and continually update a reference system to be held at its Headquarters in Switzerland, and to be made available to all who wish to use it. And, the Commission has an on-going Unit, located in England, which produces audio-visual materials (slides, films, posters...), designs and constructs mobile education units, designs equipment for environmental information centres and produces materials for wildlife club activities. I have brought some samples of the work of this Unit with me to share with you.

---

[3] World Conservation Strategy, IUCN, 1980.

In addition to these international projects, the Commission is ready to offer its services to specific requests received from countries, organizations or groups of individuals. The Commission has, for example, recently received an invitation from the Honourable Prime Minister of India to offer ways in which it could be involved in environmental education activities in this country. Other similar invitations have been received from Indonesia, Oman, Pakistan and Turkey, and all of these are being given priority attention by the Commission Officers.

This is of course only a brief presentation of the IUCN Commission on Education's work and interests. Should any of you wish to receive additional information about this, I would be most happy to provide it.

As I mentioned in my introduction, I would also like to say a few words about the International Council of Scientific Unions (ICSU) whose Secretariat is located in Paris. ICSU in an international, non-governmental scientific organization composed of 18 International Scientific Unions, 64 National Members, 17 Scientific and 4 National Associates. In addition, ICSU has set up over 20 interdisciplinary committees and commissions on specific questions of interest to a wide range of the members of the ICSU family. One of these committees is COSTED, the ICSU Committee on Science and Technology in Developing Countries, one of the co-sponsors of this Conference.

Since its creation in 1931 the Council's principal objective has been to encourage international scientific activity for the benefit of mankind. It does this by initiating, designing and co-ordinating international scientific research projects; the International Geophysical Year and the International Biological Programme are probably the best known examples. A more recent activity in conjunction with Unesco is the launching of the International Biosciences Networks which has just held a regional training course in Madurai. ICSU also acts as a focus for the exchange of ideas, the communication of scientific information and the development of standards in methodology, nomenclature and units. The various members of the ICSU family organize conferences, congresses, symposia, summer schools and meetings of experts in many parts of the world. A wide range of publications is produced, including newsletters, handbooks, proceedings of meetings, congresses and symposia, professional scientific journals, data standards, etc.[4]

The members of the International Council of Scientific Unions undertake a vast number of activities which have an educational, as well as an environmental focus. The educational activities of the International Scientific Unions are carried out by their teaching commissions, according to disciplines, and inter-disciplinary education activities within ICSU as a whole are co-ordinated by the Committee on the Teaching of Science (CTS), set up in 1968 specifically for this purpose. In addition, a number of the other interdisciplinary ICSU committees are concerned specifically with the environment.

The ICSU Committee on the Teaching of Science has been involved for a number of years in science education projects which attempt to influence science curricula so that these can be made more relevant to the needs of society. This Committee is planning a major conference on this topic for 1985, as a follow-up to a number of workshops. An affiliate of CTS, the International Council of Associations for Science Education (ICASE) has convened a number of meetings particularly relevant to environmental education, such as a meeting held in India in 1978 on Environment Science Education, and in Monaco in 1981 on Environmental Education in Europe.

The International Union of Biological Sciences' Commission on Biological Education has recently published a book on "Biological Education for Community Development" and is now working on a project linking biology to social studies, and including topics such as nutrition, environment and population.

The International Geographical Union's Commission on Geographical Education has produced teaching units on population education, and the results of the research projects of the ICSU Scientific Committee on Problems of the Environment (SCOPE) are regularly published to reach a wide public.

The ICSU Committee on Science and Technology in Developing Countries (COSTED) is well represented here, and I do not wish to speak on its behalf. But should the representative of COSTED be overly modest, I would like to say that this Committee has been extremely active since its creation in 1966 in a number of fields touching the scientific needs of developing countries, including that of environmental education. For example, beginning in 1975 COSTED organized a series of regional meetings to discuss the theme "Resources and Environment: the Role of Science Education". These meetings were held in Ghana, in Malaysia and in Argentina. More recently COSTED has sponsored a series of meetings on "Bioscience Education in Developing Countries" which considered methods of relating bioscience education to the problems of developing countries in areas such as environment, agriculture and health.

---

[4] ICSU Year Book 1981.

I would like to conclude my remarks by referring to the importance of science education for environment and thus showing the relevance to this Conference of the work of the two non-governmental organizations I have been introducing here: ICSU and IUCN. As Dr. Baez, in his speech to the International Conference on the Environment: Methods and Strategy for Integrated Development, said: "science education should help mankind improve the quality of life on this planet, and by life we mean all living things, plants and animals, and particularly people: men and women in all walks of life and in all parts of the world, developed and developing". But how could science education bring about such improvement in the quality of life? Dr. Baez suggests that "in order to enrich the quality of life, education must generate four important traits in people" which he described as the 4 Cs. These are: curiosity, creativity, competence and compassion. Curiosity is the motor that drives the scientist; creativity the spark that enables the engineer to design things that never existed before; and technology demands competence in putting them together and making them work. But science and technology thrive on each other and both of them demand all three Cs: curiosity, creativity and competence. Now the fourth C, compassion, is used here to mean "fellow-feeling and sympathy" rather than pity, and it is such compassion which can lead to the proper use of the power we can receive from science and technology. Thus, competence without compassion is inhuman and compassion without competence is ineffectual[5].

Mr. Chairman, Ladies and Gentlemen, I think that I have already taken more than my fair share of your time. I shall simply conclude by wishing this Conferencence success with its deliberations and with the implementation of its recommendations and express the hope that we shall have a chance for more direct interactions during my stay with you.

---

[5] A.V. Baez. speech to International Conference on the Environment Methods and Strategy for Integrated Development Action, Belgium, September 1979.

Present Status of Environmental Education in the Asian Region

W.D. PONNIAH*

Historical Background

In a paper of this nature it will be both relevant and informative to take a short walk down history in order to determine what the expressed environmental education needs of the countries in the region of Asia were at a certain period in time before considering their present status with regards to the needs identified by them.

Although the intellectual roots of environmental education are ancient and date back to the early 1900s we shall, however, retrace our steps only as far back as 1972 as it was only since 1972 that there has been a considerable development of activities recognised internationally as environmental education.

In 1972, the United Nations convened the International Conference on the Human Environment in Stockholm, Sweden. This was a historic meeting in the sense that it resulted in the establishment of the United Nations Environment Programme (UNEP) which, together with Unesco, launched the International Environmental Education Programme (IEEP).

The launching of IEEP is a concrete response to recommendation 96 of the UN Conference on the Human Environment which specifically stated "that the Secretary General, the organizations of the UN System, especially Unesco and the other international agencies concerned should, after consultation and agreement take the necessary steps to establish an international programme in environmental education, interdisciplinary in approach, in school and out-of-school, encompassing all levels of education......"

The programme objectives and initial programme activities of the International Environmental Education Programme are given in the charts which follow:

---

*Regional Adviser in Environmental Education in the Unesco Regional Office in Bangkok.

Oct.
1974 Programme objectives

Co-ordinate planning

Implement exchange of ideas and information

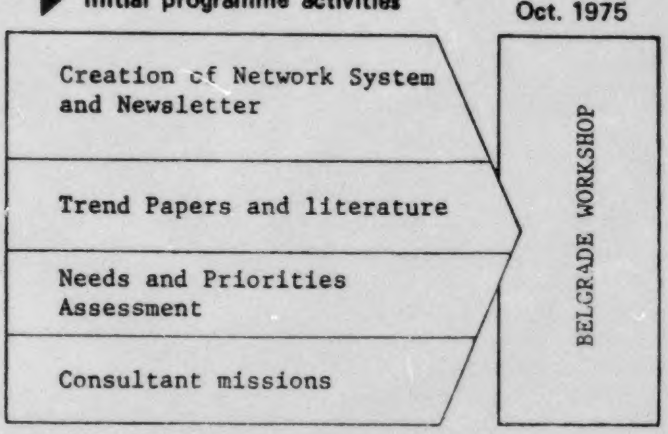
Provide advisory services

Provide, promote and co-ordinate research

Support instructional programmes and education of personnel

(*Source:* Connect, January 1976)

Initial programme activities


Oct. 1975
Creation of Network System and Newsletter
Trend Papers and literature
Needs and Priorities Assessment
Consultant missions
BELGRADE WORKSHOP

(Source : Connect, January 1976)

In 1975, IEEP organised the Belgrade International Workshop on Environmental Education. One of the inputs for this Workshop was the preliminary world survey of environmental education needs and priorities aimed at providing information permitting the formulation of effective strategies for action at the global, regional and national levels. It was principally, based on the 177-item questionnaire which was sent to Unesco's 136 Member States and which obtained the high response of 82%. An analysis of the results at the *global level* is given in Table 1.

The most striking findings of the preliminary world survey may be summarised as shown in the schema on page 120.

It will be fitting and relevant at this stage to consider the environmental education needs and priorities identified at the *regional* (Asian) *level* (Table 2.

It appears from Table 2 that the major regional need is for the development of environmental education programmes for the following educational sectors:

(i) primary level

(ii) secondary level

(iii) third level (for the training of teachers and other professionals).

For interest's sake we shall now consider the needs and priorities in environmental education expressed at the *national level* by one of the 13 countries in the region which participated in the survey. Since this important Conference on the environment is taking place in New Delhi it seems fitting to reproduce the table which gives a profile of India's needs and priorities in environmental education (Table 3).

It appears from Table 3 that India attached high priority to the development of personnel at the tertiary level aud the provision of funds at the pre-school level.

At the next lower level of environmental education needs are development of personnel at the primary and secondary educational levels and the development of organizational support at the primary level. The lowest level of needs, none the less important, are for legislation affecting environmental education at the primary educational level and for out-of-school youth, provision of funds at the primary and secondary educational level, development of instructional materials for out-of-school adults and development of personnel at the pre-school level.

The Belgrade workshop was followed by a series of regional meetings (September 1976—January 1977) in Africa, the Arab States, Europe—North America and Latin America. The Asian Regional

Table 1 : MAJOR WORLDWIDE AND REGIONAL ENVIRONMENTAL EDUCATION (EE) PROBLEMS, IDENTIFIED BY EDUCATIONAL SECTOR

EE resources by world and region / Educational sector	World							1 Africa							2 Arab States							3 Asia							4 Latin America						
	A	B	C	D	E	F	G	A	B	C	D	E	F	G	A	B	C	D	E	F	G	A	B	C	D	E	F	G	A	B	C	D	E	F	G
1. Pre-school education											•		•							•										•	•		•		•
2. First level education		•			•		•		•	•	•	•	•	•					•	•	•							•		•	•		•		•
3. Second level education		•			•		•		•	•	•	•	•	•					•	•	•							•		•	•		•		•
4. Third level education		•			•				•	•	•	•	•							•										•	•		•		•
5. Third level (general students)					•					•	•	•	•							•										•	•		•		•
6. Third level (teachers)		•			•				•	•	•	•	•	•		•				•								•		•	•		•		•
7. Third level (professionals)										•	•	•	•							•								•		•	•		•		•
8. Out-of-school youth education		•			•		•		•		•	•	•	•					•	•										•	•		•		•
9. Out-of-school adult education		•			•		•		•		•	•	•	•					•	•										•	•		•		•
10. General education system		•			•				•	•	•	•	•						•	•										•	•		•		

EE resources by world and region / Educational sector	5 North Europe							6 West Europe							7 East Europe							8 South Europe							9 North America						
	A	B	C	D	E	F	G	A	B	C	D	E	F	G	A	B	C	D	E	F	G	A	B	C	D	E	F	G	A	B	C	D	E	F	G
1. Pre-school education							•									•			•			•	•					•					•		
2. First level education		•					•									•			•			•	•					•		•			•		•
3. Second level education		•														•			•		•	•	•					•		•			•		•
4. Third level education		•														•			•		•	•	•							•			•		•
5. Third level (general students)																•			•		•	•	•							•			•		•
6. Third level (teachers)		•														•			•		•	•	•							•			•		•
7. Third level (professionals)		•														•			•		•	•	•					•		•			•		
8. Out-of-school youth education		•					•									•			•			•	•					•					•		
9. Out-of-school adult education																			•			•	•												
10. General education system		•														•			•			•	•												

Note: Problem identification criteria:

"Major" problems are identified as beed rating equal to or greater than 4, (on a 5 point scale), given by the Unesco Member States in the Survey questionnaire.

Key for EE resources:

A – Legislation, B—Funds, C—Instructional aids,
D—Physical facilities, E—Personnel, F—Organizations,
G—Programmes.

Table 2: MAJOR ENVIRONMENTAL EDUCATION (EE) PROBLEMS, IDENTIFIED BY EDUCATIONAL SECTOR
ASIA

EE resources by region / Educational Sector	Legislation	Funds	Instructional-aids	Physical facilities	Personnel	Organizations	Programmes
1. Pre-school education							
2. First level education							●
3. Second level education							●
4. Third level education							
5. Third level (general students)							
6. Third level (teachers)							●
7. Third level (professionals)							●
8. Out-of-school youth education							
9. Out-of-school adult education							
10. General educational system							

Table 3: PRINCIPAL PROBLEMS IN DEVELOPING EE PROGRAMMES FOR PRIORITY EDUCATIONAL SECTORS

(INDIA)

▤ low importance

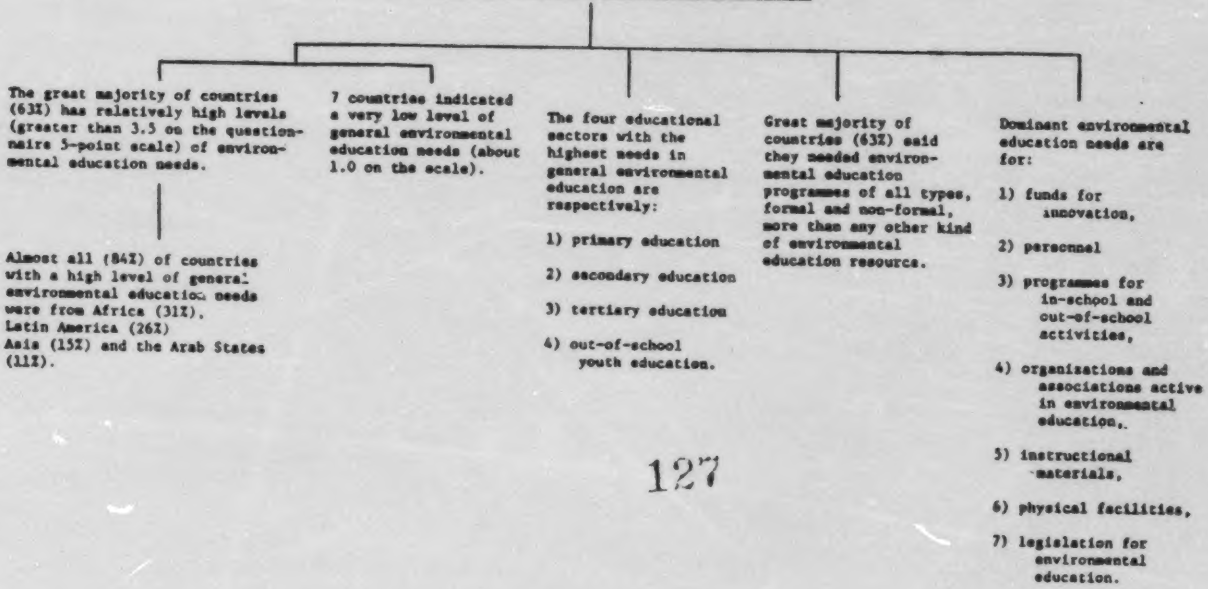
▒ medium importance

■ high importance

RESOURCES (EE) 1 / EDUC. SECTOR 2	LEGISLAT	FUNDS.	INST.AIDS	PHYS.FAC	PERSON	ORGANIZ	PRIOR ED.SECT 3
PRE-SCHOOL		■			▤		II
PRIMARY	▤	▤			▒	▒	I
SECONDARY		▤			▒		I
TERTIARY					■		III
YOUTH	▤						II
ADULTS			▤				II

1. Environmental Education (EE) Resources; 2. Educational Sectors;
4. Priority Educational Sector; Empty Cell means absence of Principal EE Problems

PRELIMINARY WORLD SURVEY OF ENVIRONMENTAL EDUCATION NEEDS AND PRIORITIES



The great majority of countries (63%) has relatively high levels (greater than 3.5 on the questionnaire 5-point scale) of environmental education needs.

Almost all (84%) of countries with a high level of general environmental education needs were from Africa (31%), Latin America (26%) Asia (15%) and the Arab States (11%).

7 countries indicated a very low level of general environmental education needs (about 1.0 on the scale).

The four educational sectors with the highest needs in general environmental education are respectively:

1) primary education

2) secondary education

3) tertiary education

4) out-of-school youth education.

Great majority of countries (63%) said they needed environmental education programmes of all types, formal and non-formal, more than any other kind of environmental education resource.

Dominant environmental education needs are for:

1) funds for innovation,

2) personnel

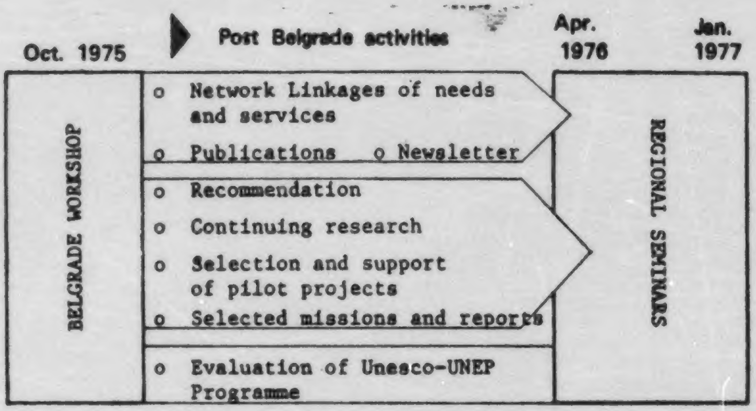
3) programmes for in-school and out-of-school activities,

4) organizations and associations active in environmental education,

5) instructional materials,

6) physical facilities,

7) legislation for environmental education.


Oct. 1975
Post Belgrade activities
Apr. 1976
Jan. 1977
BELGRADE WORKSHOP
o Network Linkages of needs and services
o Publications
o Newsletter
o Recommendation
o Continuing research
o Selection and support of pilot projects
o Selected missions and reports
o Evaluation of Unesco-UNEP Programme
REGIONAL SEMINARS

(Source : Connect, January 1976)

Meeting was held in Bangkok in November 1976. The general purpose of the regional meeting was to bring together environmental education practitioners from throughout the region to:

(a) identify and discuss regional environmental education activities,

(b) review guidelines and recommendations of the Belgrade International Workshop, and

(c) formulate strategies for further action in environmental education at the regional level.

The deliberation of the Working Groups at the Asian Regional Meeting resulted in the formulation of 15 recommendations listed under the following four problem areas:

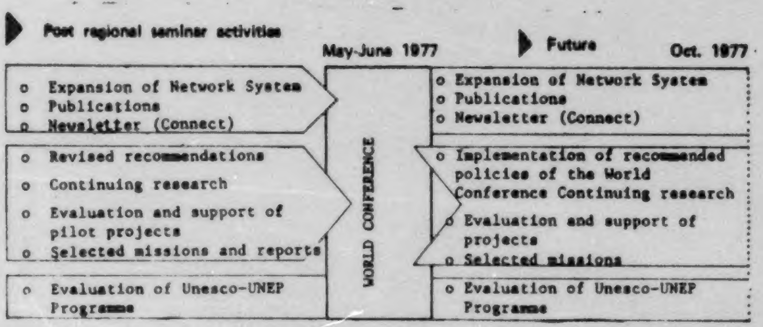
(a) programmes for environmental education

(b) personnel training

(c) non-formal environmental education

(d) materials for environmental education

The Regional Meetings were followed by the Inter-Governmental Conference on Environmental Education which was held in the city of Tbilisi, Georgia, USSR in October 1977 and which marked the culmination of the first phase of the environmental education programme. This Conference formulated 41 recommendations of which 16 are on strategies for the development of environmental education at national level.


Post regional seminar activities
May-June 1977
Future
Oct. 1977
o Expansion of Network System
o Publications
o Newsletter (Connect)
o Revised recommendations
o Continuing research
o Evaluation and support of pilot projects
o Selected missions and reports
o Evaluation of Unesco-UNEP Programme
WORLD CONFERENCE
o Expansion of Network System
o Publications
o Newsletter (Connect)
o Implementation of recommended policies of the World Conference Continuing research
o Evaluation and support of projects
o Selected missions
o Evaluation of Unesco-UNEP Programme

(*Source*: Connect, January 1976)

Following the Tbilisi Conference, the last major activity in the Asian region was the Workshop on Environmental Education which was held in Bangkok in September 1980. This Workshop had, as its objectives, the following:

—to share experiences among Member States on the development and implementation of environmental education in the region;

—to consider ways and means to further improve environmental education in the Member States of the region; namely, development and organization of curricular and instructional materials and evaluation; development and organization of teacher education; and implementation of environmental education in programmes for school and out-of-school education, and to make recommendations regarding regional co-operation in environmental education.

This meeting which was attended by 19 participants from 17 Member States made a limited number of practical and specific suggestions which are reproduced below:

1. To stimulate and facilitate the exchange of information; to continue to enhance an inventory of national institutions and programmes in environmental education.

2. To continue to collect and disseminate information and documentation. The issues of newsletter was considered as one of the means for this purpose.

3. To prepare and publish various source materials on environmental education for use in curriculum development and teacher

training at the national level, including monographs on environmentally important ecosystem such as the paddy field, water reservoirs, coastal regions and river basins.

4. To organize study visits and attachments, including those specifically for exchanging experiences among youth leaders.

5. To provide support to studies, research and experiments at national level.

6. To provide advisory services to, and participate in, activities at national level.

7. To develop a pool of experienced resource persons in the region for their possible consultancy services to the Member States.

Having given a brief review of the history of environmental education from 1972 to 1980, we shall now consider the status of environmental education based on the environmental education needs identified by countries for the following educational sectors.

—primary level

—secondary level

—third level (training of teachers and other professionals).

Primary Level Environmental Education

Until recently the science course which was offered to primary school children in Asia usually consisted of nature study in its most rudimentary descriptive form. Different parts of the curriculum were studied in isolation and little attempt was made to establish links between them. Student activities were almost always absent and a rigid syllabus with contents having no relevance to the pupil's immediate experience was attempted to be implemented through a highly formal "talk and chalk" method. Curriculum developers in most of the countries in Asia are now engaged in the task of replacing this type of conventional, inflexible and formal teaching by pupil-centred, activity-based integrated teaching. General education curricula now are usually centred around and spiral from the total environment of the pupil.

In the integrated general science curriculum developed for primary schools by the Curriculum Development Centre of Sri Lanka, for example, each turn of the spiral covers eleven themes: houses and the people who live in them, things we eat and drink, things we wear, things which help us work, how we live in mixed communities, the world around us, our school and its neighbourhood, the people who help us, how we travel and communicate, our earth and the sky above it, and things we see and hear. Although other parts of the total curricula (including language and mathematics) are not integrated with the science curriculum, the degree of integration incorporated in the latter is quite remarkable.

In Thailand, the new elementary school curriculum is divided into four integrated groups of experiences: basic skills, *life experiences*, character education and work experience. The *life experiences* programme includes, amongst other subject areas, social studies, environmental studies and health education.

Most of the countries in the region have independently developed similar curricula, although in some, despite attempted integration, vestiges of single discipline study still persist. In Indonesia, for instance, the general education curriculum is built around nine areas of study: religion, Pancasila, moral education, language, mathematics, social sciences, natural sciences, sports and health, arts and special skills. Topics related to environmental education are treated mainly as subtopics in natural and social sciences. To overcome this dispersive approach, an experimental project has been launched in the municipal schools in Jakarta under the sponsorship of Unesco. The pilot project is based on research leading to the identification of those learning situations in primary schools which lend themselves most suitably for adoption of an integrated approach to environmental education.

The project, after evaluation, is planned to be extended to all primary schools in Indonesia.

The "General Knowledge" course in *China* includes topics like animals, plants, micro-organisms, physical geography and personal hygiene. It is hoped in the near future to include topics such as 'environment', 'environment and ecological balance', 'environment and health' and 'environmental protection'.

In the 'Environmental Studies' programme in *India*, learning is mainly through activities based on observations of the local environment (both social and physical). Children are encouraged to investigate their immediate environment as well as to perform experiments using locally available resources.

One of the most innovative programmes in pre-primary and lower primary environmental education (EE) was launched more than a decade ago in Burma, which is among the countries in Asia least affected by industrial pollution. The programme is firmly rooted in the conviction that children should develop from an early age a healthy, optimistic view of their environment, realizing that they are themselves part of nature and that education is relevant to their surroundings. In this "Patwinkyn" or "Surroundings" programme, text books are dispensed with and the children are encouraged to learn directly from their environment. In *Bangladesh* a similar programme, entitled "Muktangan Siksha" or "Open Air Education", was launched as a pilot project in 1976. But the new curricula for the primary grades, however, includes a subject entitled Environment Learning. The contents headings for the syllabus include family environment, food, clothing and shelter for the family, different types of houses in the local community; domesticated animals and birds, concepts related to direction, time, distance, light, climate and seasons, environment of the school, social environment of village and the professions of the people in the locality, local communication system, local history, importance of clear and clean environment, recreation during leisure, observation of local environment and its natural characteristics. As in the "Muktangan Siksha" programme there are no textbooks for the pupils but only guidebooks for the teachers.

The new Course of Study for primary and lower secondary levels in *Japan* was reformed in 1977, the one for upper secondary in 1978. Environmental education is not treated as an independent subject; its essential contents are included in the areas of social studies, science, physical education and moral education at the primary level.

It appears that at the primary school level, social studies is the principal subject area involving environmental education. Some aspects, such as "understanding and love of nature" are taught in science, "health and environment" in physical education, "appreciation and protection of nature and taking affectionate interest in animals and plants" in moral education.

Secondary Level Environmental Education

Areas lending themselves easily to incorporation of the environmental dimension are science courses at the upper secondary level, which are not professionally oriented, and integrated general science courses at the lower secondary level. In the design of integrated science curricula, environment is often used as a core theme around which the entire course is developed. This is essentially the approach adopted by the Institute for the Promotion of Science and Technology (IPST) of Thailand.

The IPST integrated science curriculum interrelates change, energy and environment. Attention is also paid to the development of skills and of a scientific attitude in pupils who follow this triangular theme, integrating laboratory work with the theoretical contents of the course. Typically, curriculum writers personally experienced the problems of growing rice before the topic "Science from the Rice Paddy" was finally introduced into the curriculum.

A modular approach has also been developed by IPST of *Thailand* for an interdisciplinary course at the upper secondary level. The modules are topic-centred and aim at providing competency and motivation for learners to deal with scientific aspects of problems of a developing society, to cope with the problems of their environment and to apply science in their daily life. Self-learning instructional modules on environmental topics are also the basis of the Unesco-sponsored EE project for primary school teachers in four regions of India.

Several techniques have been developed for introducing environmental education in nonprofessional courses at the upper secondary level. In *Singapore*, it is compulsory for students in the arts to study one science subject. A popular choice is the relatively new subject "Human and Social Biology". Two important sections of the subject deal respectively with world population and individual and communal responsibility, emphasizing population aspects of environment and concerted community action for environmental sanitation and control. In *Malaysia*, the "infusional" method has been used, for example, injecting population and environmental topics into such disciplines as home science, human biology, geography, etc.

In *Bangladesh*, for example, the population education curricula includes certain environment-related topics such as population and environment, population growth and natural environment, nature and human society, population and environment (soil, water and air).

Attempts are being made in *Indonesia* and *Malaysia*, among other countries in the region, to incorporate project type activities in formal school education. It is hoped that through this approach real-life situations will be explored to help teachers overcome psychological inhibitions resulting from their previous discipline-based education.

Professionally-oriented courses at the higher secondary level are always developed in terms of single disciplines. They are conceptually oriented and deliberately aimed at a high, intellectually stimulating level. Nevertheless attempts have been made to incorporate environmentally significant topics as well. In the IPST curriculum in biology, for example, the ecosystem, environmental balance and natural resource conservation are discussed in depth. Industrial chemistry and its impact on the environment are dealt within the chemistry course. Similar attempts to orient curriculum towards environmental problems is almost universal in the Asian region.

At the secondary level in *Japan*, development of understanding of the importance of the environment and of natural resources based on respect for human dignity is stressed in social studies. In science, "providing fundamental understanding of the natural environment" is regarded as one of the central themes at the lower secondary level, and "development of a comprehensive view of nature" as represented by "the balance of nature" at the upper secondary level. This point is specially stressed in Science I. which is a compulsory course in first year of upper secondary school. In health and hygiene, "understanding of the inseparable relationship between one's helth and one's behaviour in daily life and one's environment" is regarded as the fundamental theme.

Third-level Environmental Education: Training of Teachers

(a) At primary level

In implementation of integrated EE programmes, teachers are required to play a role which is quite different from the traditional one. First of all, the curriculum is pupil-centred and it is necessary to re-train teachers so as to make them familiar with the new perspective. Activity-based programmes also call for initiative and innovative spirit on their part. Development of personal values being one of the primary goals of environmental education, teachers should not only be led to examine and develop their own values, they should also be trained in the methods leading to such developments in their students.

Largely due to resource constraints in most Asian countries, it is not possible to develop national in-service or pre-service teacher training programmes incorporating all the above objectives. As it is, in many of the countries of the region even the number of conventionally trained primary teachers is insignificant compared to the numbers required. Fortunately, encouraging developments are taking place in the field of teacher education which are conducive of the growth of teacher-training programmes for environmental education. Institutionalization of decentralized resource centres and development of a variety of decentralized models for short-term and long-term teacher training in a number of countries in the region are of significance to environmental education as well. Another change which has been noticeable during the past several years is the increasing involvement of teachers in curricular and other developments in their fields. However, available teacher-training programmes related to EE are still both qualitatively and quantitatively inadequate.

The multiplier effect of teaching teacher-trainers has often been undertaken for effectively reaching large number of teachers in environmental education. Teacher's guidebooks, handbook and modules for teacher education have also been produced in some countries of the region. The Patwinkyn programme of Burma has developed comprehensive guidebooks for teachers involved in programmes in which pupils do not use text books and lean heavily on the initiative and knowledge of their teachers. A similar handbook has also been produced in Bangladesh. Occasionally mass media have also been used when a programme is implemented in remote areas.

In Asia, cultural education is usually included at the primary level as a part of moral or religious education. For instance, in Burma, Indonesia, Japan, Korea, Philippines, Thailand and Singapore, moral education is a compulsory part of the primary curriculum. In Indonesia, Malaysia, Pakistan and several other countries in the region, moral education has been integrated with religious education. In addition, social sciences incorporate the incidental teaching of moral values. It should also be noted that in many pre-primary and primary schools in Asia, music, dance, drama, etc., are included either in curricular or in extracurricular activities. Again, students participate in these cultural activities as separate areas of study and the concept of the total environment as an integrated system, including the cultural environment, is not developed.

(*b*) *At secondary level*

In several countries of Asia, teacher-training institutions for secondary school teachers have included environmental education as a component of the courses offered. In all teacher colleges in Thailand, for example, the curriculum includes two courses on ecology and on the conservation of natural resources. Environmental education is an optional subject in the Bachelor of Education programme of the University of Agriculture of *Malaysia* and the University of Malaya, Kuala

Lumpur, while for students in the School of Educational Studies of the Sains University of Malaysia, environment is a major area of study in the course on contemporary educational problems and issues.

In the four *Indonesian* national teacher-training institutes, environmental education is treated as a part of the population education courses. These courses are compulsory for students of both science and the humanities and include topics such as the impact of population growth on socio-economic development, land-use, water management, the energy problem, conservation of natural resources, public health, nutrition, etc. Pedagogical aspects of population and environmental education are also included. Since the programme is interdisciplinary, a team-teaching approach has been adopted. In spite of many practical difficulties, this interdisciplinary teaching innovation has proved to be useful in many ways, not least of which is that it has led to a better appreciation of interrelationships among different components of the environment. A very good example of interdisciplinary team-teaching is provided by the inter-faculty training programme organized for students in the Faculty of Education of the Chiengmai University of Thailand, who take courses related to environmental education in different faculties of the University, such as the faculties of science, agriculture, etc. In a Unesco-sponsored pilot project in the Philippines, the team-teaching technique was applied very successfully.

Third Level Environmental Education: Training of Professionals (Other Than Teachers)

Before we consider the next environmental education need expressed by countries in the region and which is the training of professionals (other than teachers) it will be necessary to define the term *environmental training*. As understood by Unesco, environmental training is applicable to a special group of persons, i.e., specialists and technicians—who have to undertake assessment and management tasks. For these people it provides specialised knowledge, advanced skills, techniques and expertise necessary to handle and solve environmental problems, effective utilization of natural resources and to protect and restore the quality of the environment.

The environmental education and training of particular professional or social groups lie in that overlapping portion of the education-training continuum (Fig. 1) in which *education for increased understanding* of environmental problems is just as important as, and takes place simultaneously with, *training for competence* in those areas of technical and professional practice which carry important implications for, or have

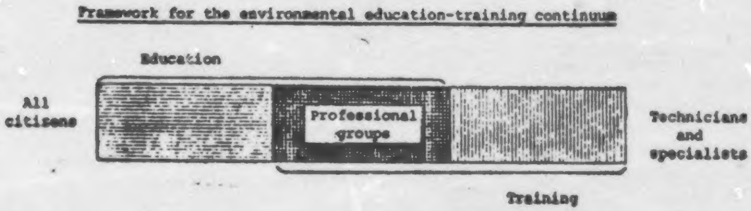

Framework for the environmental education-training continuum
Education
All citizens
Professional groups
Technicians and specialists
Training

Fig 1: Environmental education-training continuum
(*Source*: UNEP/ENVED 9)

direct bearing, on environmental concerns. The target group for this type of integrated (education-training) activity include engineers, architects, town-planners, doctors, lawyers, economists, planners, industrialists, policy-makers and decision-makers.

Although many universities in the region do provide general environmental education courses at the tertiary level, only a few of them provide environmental education and training for specialists. The list of tertiary institutions in the region which provide such training is given below.

In *Thailand*, the Environmental Education and Research Project established since September 1974 in the Faculty of Environment and Resource Studies, Mahidol University, is a 2-year post-graduate programme which covers a wide range of environmental courses supplemented by field studies. The list of courses include:

(a) Ecological Systems Analysis

(b) Introduction to Mathematics and Sciences

(c) Systems Approach and Cybernetics

(d) Pollution Problems and Control I and II

(e) Introduction to Environment and Management

(f) Population Studies

(g) Sociology and the Human Envionment

(h) Environmental Conservation and Natural Resources Management

(i) Mathematics applied to Environmental Systems

(j) Systems for Environmental Administration

(k) Physical Planning

(l) Special Planning

The College of Engineering, Chulalongkorn University has had a long interest in the environmental education and training of engineers. It hosted short training courses in some specialised areas of environmental protection such as air pollution monitoring workshop in collaboration with UNEP and WHO in 1976.

The Division of Environmental Engineering of the Asian Institute of Technology, Bangkok, offers graduate environmental education and training in two fields, namely Water and Wastewater Engineering and Environmental Technology and Management. The courses offered emphasise on the technology of waste treatment and include:

(a) Air Pollution and Laboratory Analytical and Monitoring Techniques

(b) Water Pollution and Laboratory Testing and Analysis Methods

(c) Solid Waste Handling and Disposal

(d) Industrial Wastewater Pollution Control

(e) Fundamentals of Environmental Health

(f) Environmental Quality Management

(g) Ecological Studies

(h) Environmental Chemistry and Laboratory

(i) Applied Microbiology and Bioengineering

(j) Water and Wastewater Engineering Design

(k) Environmental Engineering Laboratory

(l) Environmental Unit Operation

(m) Environmental Unit Processes

(n) Noise and its Control

(o) Marine Pollution

In *Singapore*, the National University (NUS) has been conducting a number of projects with an interdisciplinary focus. One of the projects arose as a result of the mass deaths of tilapia (*Sarotherodon mossambica*) in a reservior. Sufficient funds were made available for a study of the problem which included measuring wind velocities, water temperature gradients, water velocities at different depths and a radioactive tracer. The project brought together a team of zoologists, meterologists, geomorphologists, hydrologists, and physicists. Through the expertise of these multidisciplines, an interdisciplinary problem was solved.

Also in *Singapore*, there is a unique system in operation for the on-the-job training of specialists—environmental engineers, physical scientists and agricultural scientists. Nine government organisations were involved in a number of projects in the areas of environmental engineering, physical science and agricultural science from 1970-1979 (Table 4).

Most of the projects were conducted by the specialist in the respective organisations although in some cases help was sought from specialists in tertiary institutions. The aim of such project is to build-up a cadre of 'in house' experts who will be able to provide practical solutions to environmental problems in their respective specialist fields when called upon to do so.

In the *Philippins*, for example, professional training programmes on environmental protection and management have typically evolved out of degree programmes in sanitary engineering and public health engineering.

There are nine educational institutions offering terary and post-tertiary degree programmes in the Philippines falling in either of Sanitary Engineering, Public Health or Hygiene. These are: the University of the Philippines, National University, Mapua Institute of Technology and Feati University all in Manila; the Cebu Institute of Technology, University of Southern Philippines and the Colegio de San Jose-Recollectos in Cebu; University of Pangasinan in Pangasinan Province; and the Central Philippines University in Iloilo. Of these, two viz., the University of the Philippines and the National University are offering Master's Degree.

The thrust of the B.S. Sanitary Engineering/Hygiene/Public Health programme is:

> "..primariy for the professional training of engineers in the management of the environment. The courses deal with the theories and the applications of the principles involved in the control of the physical, chemical and biological elements in the environment. The presence of certain chemical substances or biological organisms in water or in the air, or in food, or in sewage, and

TABLE 4

Environmental R & D projects conducted by Government departments and statutory boards, 1970-1979

Discipline	*Ministry/ Department*	*Project*
Environmental Engineering	Public Works Department	Geology of the Republic of Singapore Research on sub-soil parameters Traffic management (also considered the effects on air quality)
	Ministry of the Environment	Improvement of the operation of sewerage treatment works Evaluating the technical and economic feasibility of treating waste water to potable water standards Effects of the discharge of waste water on aquatic life Clarification of waste waters using chemical additives Mechanical sullage dewatering and sullage handling system Disposal of radioactive waste Sanitary quality/bacteria contamination of water for swimming and recreational purpose Bio-assay of fish culture in reclaimed waters Poly-aromatic hydrocarbons in water Dissolved solids removal by reverse osmosis and ion-exchange
	Jurong Town Corporotion	Recovering of effluent water for industrial use
	Primary Production Department	Monitoring waste and waste water from intensive Pig Farming Estates Design of waste water collection, handling, treatment and disposal

(Contd.)

Discipline	*Ministry/ Department*	*Project*
		Assess environmental impact of intensive pig farming on river basins
	Port of Singapore Authority and Housing and Development Board	Study of various measures to protect beaches formed along reclaimed land Design and prediction of the growth and long-term stability of headland bay beaches Hydraulic models and full scale prototype models of Singapore
Physical Science	Meteorological Service Singapore	Synoptic conditions accompanying unusual phenomena Diagnostic studies of eastward moving disturbances in the S-W monsoon flow Development of Numerical Weather Prediction models Mathematical analysis of inertia gravity waves Analysis of low level strong wind belt over South-China Sea during the N-E monsoon
	Singapore Institute of Standards and Industrial Research	Design of pollution control system Development of a pocket radiation alarm meter
	Department of Scientific Service	Background radiation levels in Singapore Level of lead in workers Treatment of trade effluents and design of design plants of exhaust ventilation systems in industry
Agricultural Science	Primary Production Department	Crop improvement Pesticides Chemical weed control Improvement of cultivated soils and fertilizer studies Pig production research Aquaculture

(*Source*: Background Paper by Pakiam)[6] their relationship to disease are just a few examples of the basic principles covered in these environmental science courses. Control of the environment through the design, construction and maintenance of engineering structure such as water purification plants, sewage treatment plants, mechanical or other equipment to control air pollution or safety devices to prevent accidents in industry are some of the practical applications of the fundamental principles learned from these courses."

The School of Environmental Studies was established in 1975 in the Jawaharlal Nehru University, *New Delhi*. The school has a faulty of seventeen representing various fields such as Philosophy, Ecology Environmental Engineering, Biophysics, Physics, Geology, Chemistry, Botany, veterinary Science and Molecular Biology. It offers three study programmes—a Master's Degree, a Master of Philosophy (which requires one additional year of study after M.Sc.) and a Ph.D. degree.

Current and planned research projects include:

(a) Limnological studies of Lake Chilka

(b) Loktak Lake Project

(c) Nitrogen fixation of non-leguminous flowering plants

(d) Metals in water and water pollution

(e) Geology of oceans

(f) Geochemistry of river basins in India

(g) Geochemistry of ultrabasic rocks in Kola Gold Fields

In addition, short-term training courses on estuaries and marine environment and aquatic ecology have been organised by the School of Enviromental Sciences for government officials.

Also in *India*, the School of Environmental Studies in the University of Poona has formulated a programme of research and development with a rural bias. The main aspects of this programme, including those under the auspics of the School of Environmental Studies, are given below:

(a) effective harnessing and utilisation of energy,

(b) development of local materials for rural industry,

(c) bio-medical awareness and solutions of health problems

(d) improvement and understanding of environmental conditions and eco system, and finally

(e) adoption of modern techniques for 'distance teaching' to disseminate scientific information and knowledge connected with all the above mentioned facts, in the language that the rural population understand.

A co-ordinated research programme in environmental studies has been proposed with the following objectives:

(a) evaluation of the various parameters constituting the eco system in the uplands of Western Maharashtra

(b) identification of problems requiring immediate attention, especially those relevant to day-to-day needs

(c) development and fabrication of cheap techno-system which could be used for monitoring and improving the eco system.

Four areas representing different geographic and economic settings have been chosen for pilot studies. These are:

(a) the Poona Metropolitan area,

(b) the area around Mulshi, South-West of Poona,

(c) the Shivagangu basin South of Poona, and

(d) the drought prone Saswad area to the Southeast of Poona.

Government Training Programmes

Musa (1981) has listed the following objectives of government training programmes in the region and has also briefly discussed environmental training activities being undertaken in countries in the region:

(a) to improve and increase awareness of, and concern for the environment by integrating the private sector and government sector's knowledge, skills, values and motivation;

(b) to provide specialized training required by technicians and specialists in relation to environmental assessment and management;

(c) to promote participation in environmental awareness among rural and urban communities.

The target groups for this integrated activity includes:

(a) teachers

(b) middle-level manpower in selected areas

(c) professionals and other specialists

A non-formal environmental training programme was initiated in *Bangladesh* for both young people and adults using the mass media. In addition, a national media seminar on "Environmental Awareness for Journalists and other Media People" was held in Dacca in January 1976. The successful termination of the above seminar has prompted the government to organise more seminars and workshops for media people.

In *India*, an environmental training programme for post-graduates has been an on-going activity in the Public Health and Engineering Department of the Jawaharlal Nehru University since 1948. The aim of the above programme is to provide environmental training for scientists and other specialists.

Community awareness training is being emphasised in *Indonesia* for the general public on matters of environmental concern particularly in interpreting local environmental problems for which timely intervention and action by the public is seen as important, necessary and desirable.

Also in Indonesia, the office of the Minister of Environment and Development Supervision has organised a number of training courses, particularly for the training of provincial development planners.

In *Malaysia*, activities relating to environmental training are part of the general process of education including the development of public awareness of the danger of environmental degradation and the need for taking into account the various components of the environment.

Finally, in the *Philippines*, the National Environmental Protection Council has adopted the environmental impact assessment system in toto for the implementation of its environmental policy. The Council has organised a series of technical workshops-cum-study tours for government personnel and environmental co-ordinators from various implementing agencies.

Conclusion

An analysis of the preliminary world survey conducted in 1975 revealed that countries in the Asian region had identified environmental education needs for the following educational sectors;

—primary level

—secondary level

—third level: training of teachers

—third level: training of professionals

A brief account of developments in environmental education at the primary and secondary levels of education and at the third level (training of teachers and other professionals) revealed that sufficient progress had been achieved at the primary and secondary levels of general education and at the third-level (training of teachers). What appears still lacking in most countries in the region is the training of professionals.

Although some universities in the region claim that they are engaged in training professionals or specialists, a close scrutiny of their programmes indicates that the courses are designed more for students at the undergraduate level than for professionals.

On the other hand, governments in many countries in the region have reported on a number of successful training programmes for media people, engineers, scientists, other professionals and government personnel (planners and decision-makers).

The importance of training professionals such as engineers, architects, town-planners, doctors, lawyers, economists, planners, industrialists, policy-makers and decision-makers cannot be underestimated as education and training for professionals are indispensable tools for stimulating action that will lead to sound environmental management.

This appears to be the consensus view of participants at the Regional Meeting of Experts in Environmental Education (Bangkok, 1976), when they recommended that:

> "as a matter of urgency special post-graduate programmes on environmental education be established for training people already specialised. It is considered that a problem solving approach on an integrated multidisciplinary team basis is an effective method of training. The new type of professionals produced, while retaining their original expertise will have acquired the ability to work as

members of multi-disciplinary teams. They may be appropriately described as integrationists as distinct from generalists or specialists."

The message is thus clear that universities in the region should embark on programmes aimed at providing environmental education and training for their professionals or, as in the case of the Singapore experience, to conduct "in house" training of specialists.

References

1. Abito, G.F., *Environmental Education, Training and Research in the Philippines.* RIHED background paper presented at the Regional Conference on Environmental.
2. *Connect,* Unesco-UNEP Environmental Education Newsletter, Jan. 1976, Sept. 1976, Unesco, Paris.
3. *Final Report of the Regional Meeting of Experts on Environmental Education in Asia,* Bangkok, 1976.
4. Kershaw, W.E., Francis, G.R., Phantumwanit, D., *Status Report of the University Level Integrated Environmental Education Programme,* UNEP, Bangkok, 1978.
5. Musa, A.B.M., "Environmental Education and Training". In Desh Bandhu and G.S. Aulakh (Eds.), *Environmental Education,* New Delhi: Satish Composing Agency, 1981.
6. Pakiam, J.E., *Environmental Education and Research in Singapore.* RIHED background paper Education in ASEAN Universities and its Transfer, August 18-21, 1981. University Pertanian Malaysia, Serdang Malaysia.
7. *The United Nations Environment Programme and its contribution to the development of environmental education and training,* Paris, Unesco, 1977. (UNEP/ENVED 9).
8. *Intergovernmental Conference on Environmental Education—Needs and Priorities in Environmental Education : An International Survey.* Paris, Unesco, 1977. (UNEP/ENVED 6).

Contributed Papers

The Philosophy and Practice of Environmental Education in the Tropics: A Critical Assessment

MICHAEL H. ROBINSON

Introduction

A biologist whose life is devoted to academically-oriented basic research, would, at first sight, appear to be ill-qualified for discussing the aims and content of environmental education. Any practising educator could immediately react by saying, "Well, he may know a lot about the environment, but what does he know about education?" This is an entirely valid objection. One of the blights on the life of hardworking schoolteachers is that they are often subjected to the ill-considered advice of amateurs. This is certainly true in my own country and may well be true throughout the world. The fact of the matter is that everybody thinks that they know *what* and *how* to teach. This is often an unfounded belief. I have, therefore, to show that my credentials for discussing tropical environmental education are a little more respectable than they may seem at first sight. Firstly, I am a trained teacher and before becoming a researcher spent many years teaching a variety of subjects in secondary schools, specializing for most of the time in teaching Biology, General Science and History. Practical school-teaching experience is important to introduce an element of realism into any discussion of environmental education. Many specialist educationists have never had the experience of trying to educate. Secondly, I can claim some environmental experience. I have been a tropical biologist for over fifteen years and have carried out research, actually worked, in every major tropical biogeographic region. Since I am a student of ethology, of animal behaviour, this means that I have worked, not in the laboratory, but in the natural conditions of life. Also since my studies have been largely confined to the tropics, this means that they have taken place entirely in the so-called "Third

---

Smithsonian Tropical Research Institute, P.O. Box 2072, Balboa, Republic de Panama.

(The opinions expressed in this paper are those of the Author and do not necessarily represent those of S.T.R.I.)

World". This too, like having been a teacher, and being a field biologist, is a good basis for *realism.*

My emphasis on realism is not accidental. I have a deep rooted conviction that environmental education suffers from what can only be called "The Enlightenment Fallacy". This fallacy also afflicts the environmental movements in most countries. The fallacy can be described as the view that education and knowledge can solve all problems. There is a thread of this magnificent obsession all the way from Diderot to H.G. Wells. At the close of the twentieth century, there are many cynics who deny all hope for mankind but subscribe to the enlightenment fallacy in their day-to-day activities. They behave as though they think that education can save the magnificent tropical forests of the world from destruction. It is out of place here to make a detailed analysis of the reasons why education and knowledge *alone* are insufficient to solve the problems facing makind in the tropics and ensure rational exploitation of the environment. The essence of the difficulty is easy to summarise: solving environmental problems depends on controlling political and economic problems as well as controlling human behaviour. We have no reason to hope that political and economic forces, or human behaviour, will in the future be any more susceptible to the effects of enlightenment than has been the case in the past. The history of this century alone is sufficient to make all predictions gloomy. Rather than comment directly on present political problems, always an indelicate thing to do, a single quote from the distant past can stand in summary. The incomparable Voltaire said, "god is on the side of the big batallions"; when he said this he was certainly not referring to public opinion.

In the tropics, the conflict between short-term interests of human populations and the long-term goals of wise environmental management is much more immediate and acute than it is in most temperate countries where the Ecology Movement originated. The reasons for this need stating clearly to avoid a charge of "developed nation chauvinism". The reasons are twofold. The most important one is that most of the developed nations have already destroyed or profoundly modified a substantial part of their natural environment, during their development. The Industrial Revolution now taking place in the Third World took place over a century ago in most developed countries. The Northern Industrial Revolution merely scarred an already radically perturbed environment. The clearing, to provide agricultural land, that now scars many of the world's tropical forests, took place centuries ago in the world's temperate forests. What I see taking place when I work in Papua New Guinea took place in my own England long before the industrial revolution. The famous Domesdae Book, produced by conquering Normans, in the eleventh century A.D. catalogues, among other things, the vast areas of forest then present in England that were destroyed by the subsequent agricultural revolutions. What English environmentalists now struggle to save are the final tiny relics of a huge ecosystem. One of these relics is the roadside verge, often rich in wildflowers. This is "fine-scale" conservation compared to what is now threatened in the tropics. The second reason for the fundamental nature of the difference between tropical and temperate environmental problems is, like the first, relativistic. It concerns the degree of pressure that is being exerted on the environment. As a broad generalization, it is true to say that famine does not occur in the developed temperate regions but is an ever present possibility, or reality, in many tropical regions. There is thus produced a situation where basic human needs exert a tremendous pressure for environmental change exactly in those places where there is most unchanged environment left to save. This produces a situation that stretches the ethical sensibilities of scientists to the extreme. How can one say to hungry people that they should not destroy the tropical rainforest to satisfy their needs for food and fuel? How can a representative of a North Temperate developed nation say that? My own ancestors (as Norman serfs?) cut down the English oak/sycamore woodlands for precisely these reasons.

The conflict between man's activities and the continued existence of really complex ecosystems has been characterized as a confrontation between the technosphere and the biosphere. This is an epigram of considerable elegance but it is not really true. The technology involved in slash and burn agriculture is of a very low order indeed. It may simply involve fire and some system of plant propagation, but can be destructive on a grand scale. The conflict is really between a single dominant element of the biosphere and the rest. A match between Man and The Others. It is significant that real persturbations only occur when the populations of man increase beyond a certain point. To return to the starting point. The tropics are in the greatest danger and I don't think that the problem can be solved by environmental education because the problem is really not one of attitudes but of a desperate need to satisfy human survival requirements. It is almost certain that the solution can only be global and though enlightenment may help, it needs hard political/economic action. Let me register my scepticism about magnificent idealism and pass on to a less exalted view of the function of environmental education. The Belgrade Charter of 1975 has a magniloquent preamble that expresses all the unrealistic idealism of international conservationism—"What we need is nothing short of a new global ethic—an ethic which espouses attitudes and behaviour for individuals and societies which are consonant with humanity's place within the biosphere." True, but......

I view all of this with increasing pessimism. As the fine words multiply, the research effort in fundamental ecology stays the same or is actually reduced. Despite all this pessimism, I would still advocate investment in environmental education. It can be important at several levels. Firstly, it can provide an antidote for mistakes planning, development and government that result simply from ignorance and stupidity rather than dire necessity. In other words, it could result in the training of a less bungling top management elite. It can also create, or help to create, a climate of public opinion that could help to exert pressures for the right decisions by government, (or at the very least, pressure for choosing the least offensive of the possible alternatives). This possible effect of environmental education means that it may not function as a politically neutral subject; this aspect must be faced and is dealt with in detail below. Furthermore, environmental education may be a useful tool for educationalist. At a time when every other subject in the educational curriculum is becoming more specialized and apparently separate from every other subject, environmental science/studies can have intrinsic value as a unifying device. Properly taught, it can bring together as an integrated whole a series of other wise disparate and isolated subjects. It should be a meeting point for Biology, Chemistry, Physics, Geology, Geography, Sociology, History and so on. It can even be taught in such a way that groups of teachers combine to produce that unusual product of classroom education: the broad view. Before examining in detail how an environmental education course might be organized, it is worth attending to its politically subversive characteristics.

Environmental Education and Political Sensitivities

Environmental education, it must be admitted, can only result in attitudes on specific cases where the long-term interests of our species must be viewed as conflicting with short-term plans. The alternative is to teach the subject like ancient history, as if it had no relevance to present day reality. This is clearly unacceptable. As soon as specific cases are discussed they have to be examined critically and inevitably, a section of the group being educated will conclude that a particular business enterprise, politician or government is wrong. Teachers may (or may not) scrupulously present both sides of a particular issue but this will not prevent opinions being formed. Such opinions may lead to action for which environmental education may well be blamed. What should be done about this? In a sense, this consequence of environmental education is only a special case of the consequences of any kind of free education. Wise governments should tolerate the irritations that are consequent on enlightenment: they may not always do so in practice.

The Content of Environmental Education

As a highly committed person, I would put Biology as the central subject of environmental science/studies. It seems to me to be a natural core around which everything else fits. I also feel that human beings have a basic interest in the living world around them and in animals in particular. This kind of interest may be "instinctive" (to be controversial, it could date back to the days of our hunting ancestors). It is manifested in the enormous popularity of natural history in books, films and television programmes. Animals and plants are a natural source of interest to most pupils and this can be exploited in any environmental studies syllabus. Bearing this in mind, how does one start the subject? It seems reasonable to recognize, in the field of education, that vast differences between the state of the natural environment that exists in the developed and developing worlds. I have stressed this difference in the Introduction to this paper. The essential difference is that in the greater part of the developed world, the natural environment has already been highly modified by man, whereas in the developing world, this modification has not yet reached its peak. The difference also correlates in many cases with differences in population densities and population growth curves, real and anticipated. There are some cases that do not fit into this picture. All simplifications are faulty and this is a simplification. For instance, there are countries that are industrially undeveloped but which have had large populations for a long time and where profound environmental modification has a long historical background. India is a case in point.

Despite these exceptions, tropical environmental education can have a different centre of concentration from North Temperate environmental studies. North Temperate studies could justifiably centre on environmental pollution and radiate out from there (Figure 1), whereas tropical studies could (and should) centre on environmental degradation/change and radiate from there (Figure 2). The theme of a tropical course on the possible effects of environmental changes caused by man would emphasize the interdependency of tropical biotic relationships. There is no doubt that biological studies in the tropics have lagged behind those carried out in temperate regions, both in quantity and scope. This is true despite the fact that biologically-speaking the humid tropics are the richest regions on the surface of the earth. The reason for the comparative neglect of tropical biology is simple; the world distribution of biologists follows closely the world distribution of economic wealth and not, unfortunately, the world distribution of biological riches. Not only are there fewer indigenous biologists in the tropical regions of the world, but most of them perforce, have to concentrate their research activities on problems that are immediately related to survival rather than on trying to disentangle the complexity of tropical ecology. I have argued elsewhere (Robinson 1978, 1980) that the overwhelming characteristic of tropical biology is that interspecific relationships between organisms (plants and animals) reach the height of complexity in tropical rainforests and on coral reefs. Complexity of inter-relationships implies a high degree of interdependence. This has not been rigorously proven but it is highly probable. It can certainlv be shown to be the case in many instances and is a good starting point for tropical environmental education. Since this complexity is expressed in relationships between entire plants and animals, between whole organisms that is, and biology encompasses subdisciplines dealing with the functioning constituent parts, it is more accurate to place *tropical ecology* as the centre of our scheme, rather than *tropical biology*. A definition of ecology is given below.

To simplify matters, the outline scheme for studies in environmental education shown in Figure 1 is called Scheme 1, and that shown in Figure 2 is hereafter called Scheme 2.

Before going on to consider how the essence of tropical biology could be discovered by, or demonstrated to, students, I should first like to consider the general content of environmental education in more detail. Figure 1 shows one possible organizational system for the main topics of environmental education in temperate region, developed countries. This may be too idiosyncratic a system but I think that it has some merits. It can be of use to teachers in developing countries in two ways. First of all, they could take some aspects of the present problems facing the developed world to give their students as an awful warning of what might happen in *their* future if there is no change of policy. Secondly, a contrast could be drawn between the two sets of problems, to place each set in a proper context. Syllabus writing is, of course, an occupational disease among teachers but there is no doubt that it is useful. Notice that (Figure 1) the central theme is seen to be the two faces of what can be called the high-energy society. Thus the extraordinary *per capita* consumption of fossil fuels is linked with the pollutant effects of this and other aspects of high *per capita* industrial production. Central themes in this scheme of environmental education have to be connected with eliminating pollution and searching for alternate sources of energy to replace the non-renewable fossils fuels. The scheme also has an important concentration on the anthroposphere subject centre. Here, I would suggest, consideration has to be given to human interactions. In many countries the environment of any one human being is mainly dominated by other human beings and their artifacts. As an ethologist to the Tinbergen-Lorenz school, I am strongly convinced that the study of human aggression is absolutely vital as

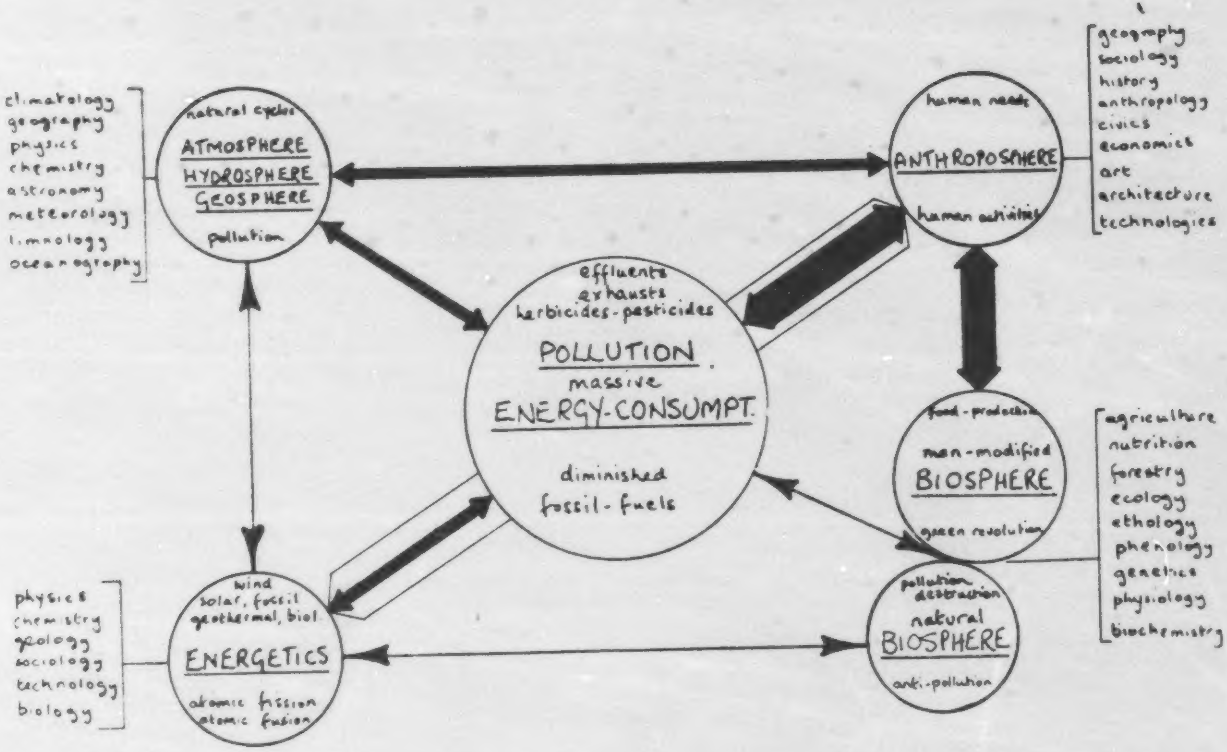

climatology
geography
physics
chemistry
astronomy
meteorology
limnology
oceanography
natural cycles
ATMOSPHERE
HYDROSPHERE
GEOSPHERE
pollution
human needs
ANTHROPOSPHERE
human activities
geography
sociology
history
anthropology
civics
economics
art
architecture
technologies
effluents
exhausts
herbicides - pesticides
POLLUTION
massive
ENERGY-CONSUMPT.
diminished
fossil - fuels
food - production
men - modified
BIOSPHERE
green revolution
agriculture
nutrition
forestry
ecology
ethology
phenology
genetics
physiology
biochemistry
pollution
destruction
natural
BIOSPHERE
anti - pollution
physics
chemistry
geology
sociology
technology
biology
wind
solar, fossil
geothermal, biol
ENERGETICS
atomic fission
atomic fusion

Figure 1

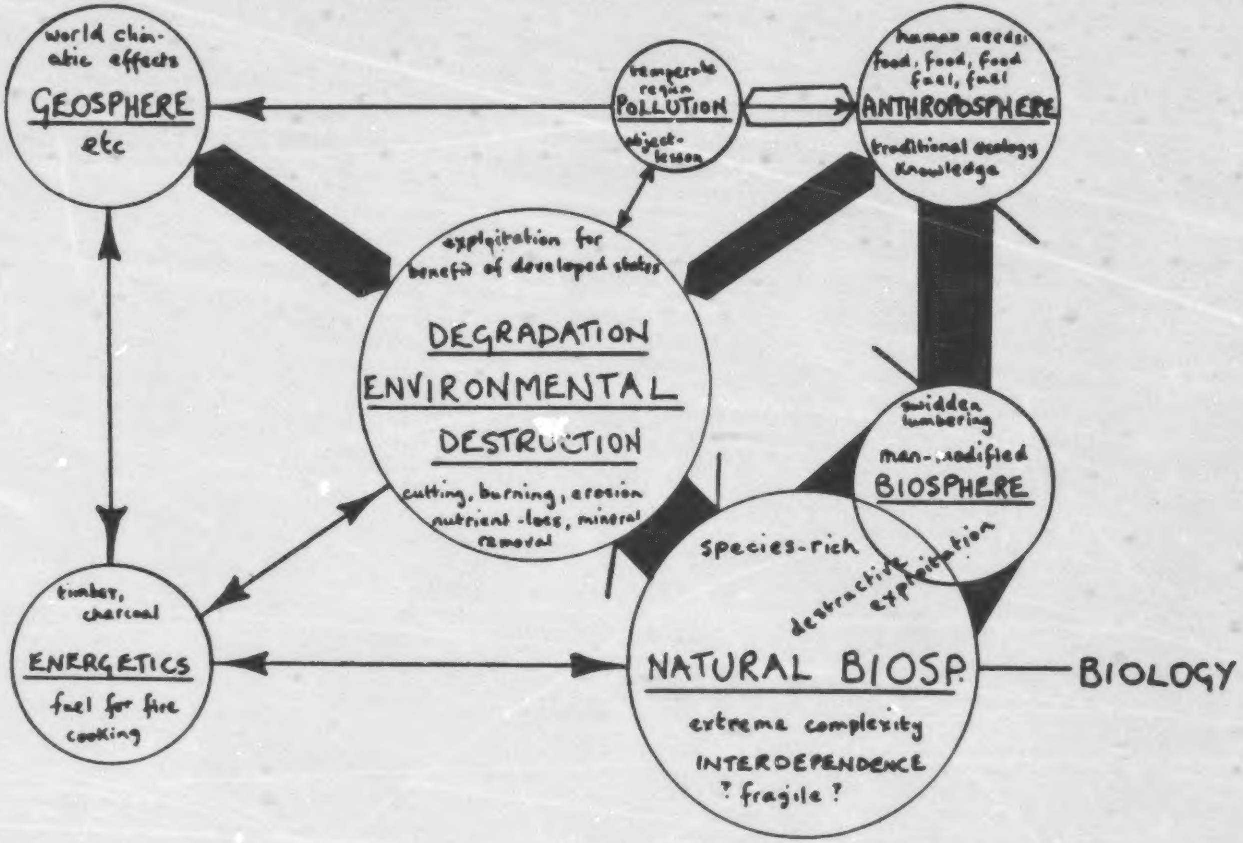

world climatic effects
GEOSPHERE
etc
temperate region
POLLUTION
object-lesson
human needs: food, food, food fuel, fuel
ANTHROPOSPHERE
traditional ecology knowledge
exploitation for benefit of developed states
DEGRADATION
ENVIRONMENTAL
DESTRUCTION
cutting, burning, erosion nutrient-loss, mineral removal
swidden lumbering
man-modified
BIOSPHERE
species-rich
destructive exploitation
timber, charcoal
ENERGETICS
fuel for fire cooking
NATURAL BIOSP.
extreme complexity
INTERDEPENDENCE
? fragile ?
BIOLOGY

Figure 2

human population densities increase. For this purpose, Tinbergen's (1968) masterly essay gives a wide range of important references and a good summary of the subject.

Notice that in this scheme and in Figure 2, I have separated the studies of the biosphere into two separate sections: the natural biosphere and the man-modified biosphere are considered separately. This is, I think, a useful distinction and reinforces the formal presentation of differences between the developed and developing worlds (compare Figures 1 and 2). In Figure 1, I have presented a partial listing of the "academic" subjects that are relevant to each of the major idea centres. This is obviously not complete but a similar listing could be produced for Figure 2. The subject categories include many that do not usually appear in the syllabus of secondary educational institutions. They are included to suggest to teachers where they might look for opinions, ideas and inspiration.

The scheme for developing countries, as noted above, concentrates on environmental change associated with the destruction of the natural environment. In addition to giving great prominence to the appreciation of the complexity and nature of the natural tropical environment, it also considers all the subject centres seen in the temperate model. The reasons for environmental change as well as the means by which this is achieved and its immediate consequences are central subjects in Scheme 2. Many developing countries have agricultural systems that were, until recently, managed by temperate region colonial powers for the benefit of temperate region consumers. Much of the Agricultural/Forestry Science applied to the tropics was designed to increase crops of exotic plants for temperate region clients or to increase indigenous crops for export to temperate markets. Attitudes have not necessarily changed since the ending of colonialism and many academic institutions received their philosophy of science from exotic sources. All this is to suggest that important discussions in tropical environmental education could be centred on the subject of whether there is an alternative to export-oriented systems. This would link nicely with a discussion of what can be called *traditional ecologies*. In some of the Third World countries where I have worked there has been a tradition of subsistence gardening that exploited the natural environment for the benefit of the local population in a conservative, non-destructive way. This was particularly true in Papua New Guinea, for instance. Studies of the "old ways" might be exteremely productive and valuable. An important element of Scheme 2 is the consideration of the possible global effects of the environmental destruction occurring in the tropics. This would concentrate on an understanding of some large-scale climatological patterns, the greenhouse effect and world temperature regimes.

In both schemes wide-ranging discussion could be provoked about ultimate aims and present methods as has already been suggested. One of the most important areas for such discussions would seem to me to be that of *appropriate technology* and *limits to growth*. In the developed world, is further consumer-oriented economic growth desirable or possible in the long-term? In the developing world, the question has to be set in a different way. How far do we want to progress and in what direction? This can be coupled with the question, does the present state of the developed world constitute a desirable model for our plans and aspirations?

I should now like to return to the consideration of some practical ways in which I think teachers of tropical ecology can use relatively simple methods to interest and inspire their pupils. These techniques have been tried out by my wife and I, on a short-term small scale, with groups of schoolchildren in Papua New Guinea and demonstrated to teachers there. They raised some enthusiasm and interest. I think they are adaptable to other countries and other situations.

Education in Tropical Ecology

Ecology has become a much-abused word. Essentially it is a synthetic subject that considers inter-relationships between living organisms and their environment. Since their environment includes other living things, the scope of ecology can be extended to include anything that relates to entire living organisms. It is thus a unifying subject within biological science and links biology to a host of other disciplines.

Ideally, all scientific education should emphasize that science proceeds by the method of investigation. This means by the proposal and testing of ideas. Experimentation is the key to good science and critical observation of natural events leads to the production of ideas that can be tested experimentally. However, a teacher faced with a large class of mixed abilities and backgrounds may find it practically impossible to pursue the ideal science curriculum and introduce his class to individual experiments. He/She may not even be able to expose them to a chance to see the natural tropical environment. (They may live in a city of millions of people, with nothing but the concrete jungle around them.) In these circumstances there may need to be a compromise between the best principles of educational psychology and the reality of what is possible. I would like to suggest some activities that require little or no elaborate (or expensive) equipment and which, nevertheless can lead pupils to discover for themselves, or have demonstrated to them, some very important aspects of the biology of tropical plants and animals. In the process, puplis can observe, measure, formulate ideas and experiment, or at least do these things at a class level if not at the individual level. The subjects of these activities are insects and spiders on the one hand and tree seedlings and soils on the other. These particular suggestions are merely meant to serve as examples but might also stimulate research scientists into thinking about the kinds of living things that would be useful for biological observations/investigations in tropical countries and are easily manipulated. Of course, one of the ideas that should be fostered in an environmental education course is a respect for living things and it is therefore important that all practical work should be carried out in such a way that cruelty to animals should be avoided. A discussion of the ethics of this issue is outside the scope of this paper, but it is well to remember that strong cultural differences exist among nations about attitudes towards animals.

Spiders As Ecological-Education Tools

Web-building spiders are common in most areas of the humid tropics and are not necessarily very seasonal in occurrence. All species are predators of insects which they catch in their often complex webs are extremely interesting animal artifacts and the construction of webs is exciting and easy to watch. The insect diet of spiders means that their activity may strongly affect a large and conspicuous part of the ecosystem. Not only that, but the relationship between the number and weight of insects caught and growth or eggproduction rates is something that can be easily measured. In tropical countries spiders are often the centre of a complex array of inter-relationships involving predators, parasites and commensals. They may thus be a focal point in a subsection of an ecosystem. For this reason some kind of set-up in which web-building spiders can be observed for longish periods (weeks, that is) can provide a good focus for a theme in tropical environmental education through which a whole range of ecological principles are discovered or deduced. Such an arrangement is shown in Figure 3. It is very simple and inexpensive to construct and, with ingenuity, a variety of materials can be substituted for those shown in the diagram. The device is essentially a structure that provides congenial conditions for a certain kind of spider to live on. It is not a cage but takes advantage of the web-site constancy of certain kinds of web-building spiders. It makes it possible to move a spider, in its web, to a variety of sites and experiment with natural food supplies and exposure to various climatic elements. This set-up requires a special kind of spider but is no problem to maintain once the spiders are established. Most orb-web spiders build a relatively ephemeral web that is rebuilt daily or at least several times a week. These spiders do not easily settle down in one place such as our spider tower. They *can* be encouraged to settle in gardens and around buildings but that is another matter. However, the so-called "tent" spiders build domed orb-webs that are relatively permanent structures and last for several weeks without renewal. The spiders that build these invest a lot of energy and silk in them and do not easily desert their web-sites. They will live quite happily, once established, in a spider tower. Tent spiders belong to the genera *Cyrtophora* and *Mecynogea*. Species of *Cyrtophora* are found commonly in trees and bushes throughout Africa, Asia and Australia. For instance, I have seen them in many parts of India, Sri Lanka, Malaysia, Papua New Guinea, Australia, West, South and East Africa and so on. The genus *Mecynogea* occurs in the New World and some *Cyrtophora* species are found in the New World tropics. If a large female *Cyrtophora* species is collected and placed on the centre of the upper strings of the spider tower she may immediately settle down, and at night she may build a web. However, if she tries to wander, it is best to confine her in the cube formed by the top of the tower. This can be done by enclosing the top in transparent plastic sheeting (polythene bags can be pinned onto the frame to wall-in a temporary cage). Inside this she should settle down to web-building quite nicely. Not all individuals are amenable to settling down and several may have to be tried before one settles and builds a dome web. Once this is built the sheeting can be carefully removed and the spider should stay happily in her frame. Some patience is required but the spiders are safe to handle (gently) and usually build a beautiful web. Once the web is completed the spider may be encouraged to stay by providing her with a meal or two. The floor beneath the web will catch the remains of the spider's prey, and these can be collected and used for a variety of measurements. After the first meals provided by the class, the spider tower can be placed at some location where natural prey will fly in and be caught and the whole system will be self-sustaining.

Once the spider is established, an ecosystem in miniature can build up around it. If the female is mature, and mated, she will lay eggs. Each batch of eggs is enclosed in an egg-cocoon of silk and hung above the centre of the dome. The oldest egg-cocoon is the highest of the string and the accumulated string of cocoons can be regarded as a scoreboard of predatory success. Eggs can be weighed and counted to give some idea of the relationship between intake of prey and egg-production. Hatching success can be measured too since the newly emerged spiderlings remain about the egg-cocoon for some days before dispersing on bridges of silk. In natural surroundings an extensive variety of insect parasitoids lay their eggs on or in the cocoons and these can be collected and counted/identified by removing the cocoon from the web and storing it in a vial. Many species of *Cyrtophora* have complex ways of trying to defend their eggs against parasites. The effort they put into this can be measured and weighed against success. Other

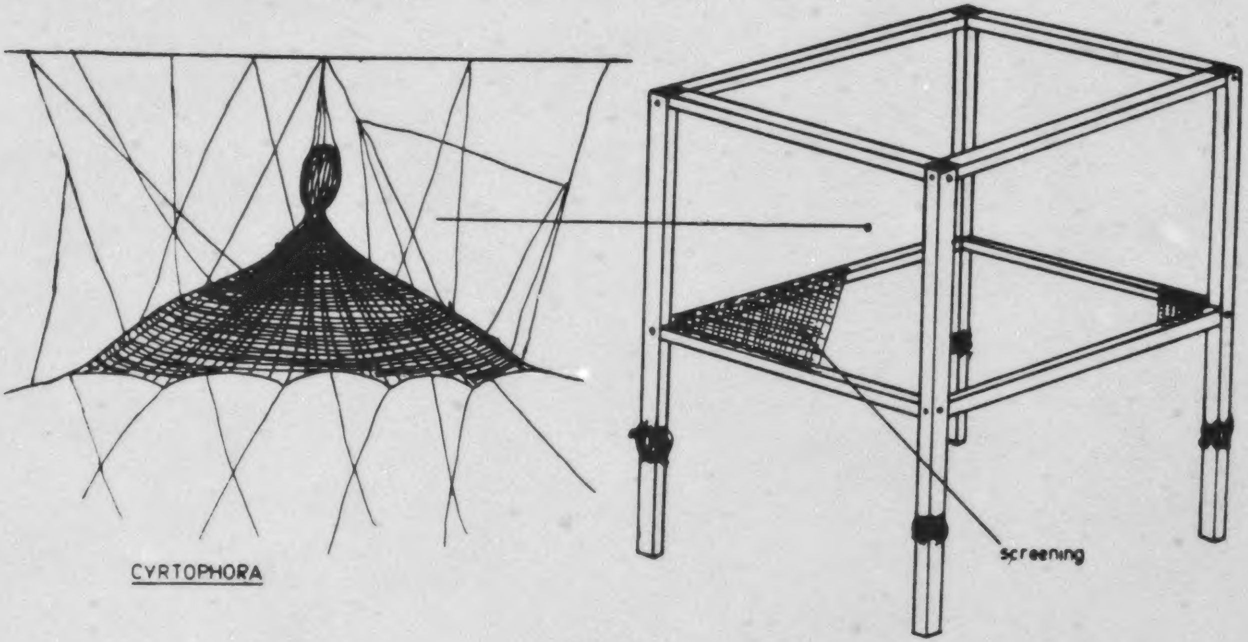

CYRTOPHORA
screening

Figure 3

aspects of complex inter-relationships can develop around this system. In nature *Cyrtophora* webs are frequented by a whole series of commensal organisms or "guests". These guests are not necessarily welcome by the host but, nevertheless, live there, enjoying the opportunities presented by their host. One set of guests live as kleptoparasites. These steal food from the host or the host web. Several species of theridiid spiders are kleptoparasites of *Cyrtophora* species. In Papua New Guinea at least three species may be found living with a single host. The number of guests supported by a host almost certainly depends on its "prosperity", on its success in catching insects. The little kleptoparsitic spiders may steal prey in several different ways and these are simple to observe. Moth caterpillars can live in the web and they feed on the exoskeletons of digested prey items.

The number of observations that can be made on the spider and its associates is very considerable. (Appendix I lists some of the projects that could be centred on a spider tower and a basic bibliography of literature on the biology of web-building spiders). For a compact and observable multispecies assemblage, the spider tower has few rivals. A really good aquarium set-up would be the nearest thing but only a marine aquarium would permit the observation of as many specialised interactions between animals. Other spiders can be encouraged to settle on spider towers. The social spider *Stegodyphus* sp. that occurs over large areas of the Old World tropics will settle down easily to a semi-captive existence but its web is extremely dense and it is less easy to observe. A wide variety of orb-weaving spiders will settle down on artificial web-supports; in many tropical areas they use telephone wires in their thousands! It is worth experimenting with these too, as a frame and string tangle may prove to be a congenial "home" for many individuals of several species.

The ideal way to introduce the class to the complexities of the tropical forest is to start with a field excursion and bring back from that the organisms that are to form the subject of later studies. Containers and observation cages can be improvised for a wide variety of tropical animals. Studies on plants can also be carried out with minimal facilities. Of course, if there is a school garden that can provide a very good site for some excellent ecological studies. A garden is underused if it is only cultivated for vegetables and grains. Growing trees from seedlings is a relatively slow process but can take place much faster in the tropics than in thé temperate zones. It can produce many interesting observations and experiments. There is not even any need for plant pots as a wide variety of improvisations are possible. One of the most dramatic of complex inter-relations is that of the vesicular-arbuscular mycorrhizae with their hosts. This is a relationship that is common throughout tropical regions and one which has profound implications for tropical land-use. To simplify the story, many species of tropical trees do not seem to be able to absorb mineral salts from the soil without the aid of V.A. mycorrhizae which grow in their roots. The mycorrhizae is a fungus that grows inside the host tissue. It is easy to demonstrate that if the mycorrhizae are absent the growth of the plant is drastically reduced even though the soil is extremely fertile. Some tree species are obligate hosts to the fungus while some do not need it at all. There are also intermediate species that can form and association but can survive without it (see Janos, 1980, for instance). Species of real forest are more likely to need myccorhizal associates than are species found in clearings and secondary growth. Grains and grasses are non-mycorrhizal. Areas that have been cleared of forest and then farmed for several years lose the spores in the soil and it is then impossible to grow trees that need mycorrhizae on these sites unless an innoculum of spores is provided.

This provides a nice system for experimentation. Soil can be sterilized and then treated in a variety of ways so that conditions can be created to determine the effect of the fungi. Tree species that need mycorrhizal associates and those that do not can be tested for growth under a considerable variety of treatments. (See Appendix II for suggestions.) This kind of study requires some patience but results are visible within months of starting. The seeds of many tropical plants are dispersed by mammals and birds and some can only germinate if they pass through the intestine of the mammal or bird first. This too is an interesting adaptation and suggests a number of experiments.

I have here outlined just two kinds of practical studies that could enrich a course in environmental studies without involving expensive equipment. Almost any organism, plant or animal, that any tropical biologist has ever worked on has some relevance to the whole subject. There is thus every reason why research scientists should take an interest in environmental education and occasionally take time off to present their results not to their scientific peers but at a more popular level. Perhaps we scientists should take the initiative and volunteer ourselves to talk about our studies to teachers and educators. The results of research should be made available at all levels of the educational system. I think that this is an obligation and duty for us all. I also think that a great many researchers would benefit from the exercise of presenting the reasons for, and results of, their studies to a non-specialist but highly critical audience.

Bibliography

Janos, D.P., 1980. Mycorrhizae influence tropical succession. *Biotropica Supplement "Tropical Succession"*: 56-64.

Robinson M.H.. 1978. Is tropical biology real? *Tropical Ecology* 19: 30-50, 1980. Existe realmente la biologia tropical? *Revista Medica de Panama*, 6:13-45.

Tinbergen, N., 1968. On war and peace in animals and man. *Science*, 160:1411-1418.

APPENDIX I

Spider Projects

1. Predation

Spiders capture insects as food. It is possible to study many aspects of their predatory activities. For instance: how to do spiders attack their prey? do they attack different kinds (sizes, weights, species) of prey in different ways? are some kinds of insect too big (or small) to be attacked? if the spider catches more than one insect what does it do with the one(s) that it is not feeding upon? what prey does the spider catch in natural conditions? does the amount of prey vary with the height of the web above the ground, or its location (the web-tower can be moved around raised and lowered)? does the spider consume all its prey, and if not what parts are left? how much weight of prey does that spider absorb at a meal (the prey can be weighed before it is given to the spider)? when the kleptoparasites steal prey how do they do so? how much do they steal? does the host know that food is being stolen? does she react to the kleptoparasites? is it possible to calculate how much a single spider kill in a year? can some insects see and avoid spider webs? can some insects escape from spider?, etc., etc.,

2. Reproduction

Male spiders are often very much smaller than females, nearly all species have a fairly complicated courtship and mating system. It is possible to study many details of reproduction. For instance: are males very different from females? how do males find females? how do males approach females? how and when do the pair mate? does one male mate more than once? does the female mate more than once? does the female attack the male? how long after mating before the eggs are laid? how are the cocoons built and where are they placed? what is the development period? how many (what weight) eggs are produced? what parasites attack the eggs? does the female protect the egg? do the spiderlings cluster after hatching? how do the young disperse? what is the morality factor? etc., etc.,

3. Web Structure and Function

Webs are complicated artifacts, they are often species—specific in structure. It is possible to study many aspects of web-building, web-structure and web-function. For instance: how long does it take to build? what weight of silk is involved? what is its form of construction? is it sticky? how does it work? how frequently is it renewed/repaired? is web size related to food supply viz., starving spider builds smaller web? can the *Cyrtophora* web be compared to a normal orb-web? are there any guests living in the web? if there are guests where do they live in the web? where do males (if any) live in the web? do any other spiders build their webs inside the framework of the *Cyrtophora* web?

These are only a small friction of the questions that can be asked and investigated. Most pupils will think of several that are not included here and most classes will produce many additional questions. The bibliography given below is chosen because it may not be too difficult to obtain in most parts of the world. References from scientific journals can sometimes be obtained free by writing to the authors but can otherwise be obtained in photocopies from University and other libraries.

Further Reading

Books

1. *Spiders and their kin, By H.W. and L. Levi.* the Golden Press, New York 1968 (This is a wonderful guide to the families and biology of spiders, copiously illustrated in colour and inexpensive as a paperback, essential reading, illustrates tropical and temperate species).
2. *Spiders, By Barbara York Main.* Collins, Sydney and London. 1976. (Excellent detailed treatment of the natural history of spiders. Emphasis is on Australian species but many of the genera are widely distributed and the ecology is applicable to the tropics).
   RELATIVELY EXPENSIVE
3. *The world of spiders, By W.S. Bristowe.* Collins, London, 1958. (This is a beautifully written book full of information but mainly based on British spiders. Highly recommended.)
   EXPENSIVE

Regional Guides

There are few regional guides to the spiders of third world tropical countries and all are specialist works. Consult the nearest University Library for information.

Technical Papers

Consult, where available, *Journal of Arachnology* (published in the U.S.A.) and *Bulletin of the British Arachnologocial Society* (published in the U.K.)

The following paper on *Cyrtophora* contains a large number of references to studies of orb-web spiders and is very useful. LUBIN, Y.D. 1980. The predatory behavior of *Cyrtophora* (Araneae: Araneidae) *Journal of Arachnology*, 8: 159-185.

APPENDIX II

Plants and Mycorrhizae

To carry out experiments on the effects of endo-mycorrhizae on growth it is usually best to grow tree species from seeds since small plants will normally have a mycorrhizal infection if collected from the forest. Seeds should be washed thoroughly and dried before being planted or, better treated with one of the many commercial seed cleansing agents. Choice of species for experimentation is dealt with below. The basis of any experiment on mycorrhizal influences is to prepare a series of plantings of different seeds in soils that are perfectly fertile but differing in whether or not they could contain the fungal spores. It is thus necessary to sterilize sufficient good quality soil to fill as many containers as will be necessary for the experimental design. Since each treatment should be repeated at least twice, and preferably more, to allow for possible seed failure the number or pots or empty oil-tins (or whatever) should be twice the number of treatments times the number of different tree species used. For example, one could try:

1. Sterilized soil alone
2. Sterilized soil+quantity X of general fertiliser
3. Sterilized soil+quantity X of unsterilized soil from any old (used for 5 years) grass (grain, rice, etc.) field
4. Sterilized soil as No. 3 but with fertiliser
5. Sterilized soil+quantity X of unsterilized forest soil
6. Sterilized soil as No. 5 plus fertiliser

Pots 1-4 would vary in fertility but would have no mycorrizal spores.

Pots 4-5 would have mycorrhizal spores and vary in fertility.

There are thus 6 treatments in this scheme (others can be designed). If 5 tree species were tested the minimum number of containers would need to be 6 (treatments) x 5 (species) x 2 (duplicates)=60

Soil sterilization can be achieved by heat or chemical treatment as described in any standard gardening text.

Chosing tree species

Most obligate mycorrhizal species DO NOT HAVE ROOT HAIRS so if you fine young seedlings growing beneath a tree and they have flourishing root hairs this is a good species to chose as a non-mycorrhizal one. For the mycorrhizal obligates trial and error may produce good results. Remember that species of mature forest are more likely to be obligated than are species of disturbed areas and secondary growth. The paper cited below has references to wide-spread studies on V.A. Endomycorrhizae and these could give clues about useful local species for experimentation. Remember that the obligate species should grow, initially, three or more times faster when they are in soil with spores in it. The difference should be visible a few months after germination. Non-mocorrhizal species will only show a difference dependent on fertility.

Important rules for the experiments:

1. Mix the soil well before planting. 2. Allow all the plants similar amounts of sunlight and water. 3. Keep a look-out for pests and seed-eaters. 4. Collect all the seeds of one species from one tree and match them for size as closely as possible. Remove them from their pods or shells and pre-soak in water if they are hard. 5. Plant several seeds in each container to allow for variations in seed fertility. Make sure that the plant pots are well-drained.

References

JANOS, D.P. 1980. Mycorrhizae influence tropical succession. Supplement to *Biotropica "Tropical Succession" 56-64.*

***This was a supplement to the journal "Biotropica" published in the U.S.A.

Youth Environmental Education and Awareness Through Extra UNEP-NGO Project Planning

TOMMY KWIK,

The time has come for the UNEP and all forward environmental bodies to contemplate on the vital question of extending our anti-pollution programmes and educational strategies to the millions of school children all over the world. It is certainly not enough for the UNEP and other regional/national bodies to have reports, press releases and newsletters sent out regularly for adult and institutional consumption. The child, who would be the citizen and leader of tomorrow, must be taught early in life the pollution hazards and environmental problems facing the world in a way a young mind can appreciate and absorb. The present generations of unresponsive, indifferent and unmotivated individuals may be the result of our past ignorance and complacency. Today, pollution of the world environment requires our earnest attention and action if we are to avert a global collapse. Climatic changes, disappearance of wild life, desertification, increased severity of smogs and forest fires, etc. all these are indication that the world environment is not well.

The annual UNEP State of the World Environment report and newsletters are not enough. It is too heavy for children to read and peruse. When these reports appear in the newspapers and TV, we may think that they would reach both the adults and children. The truth is that a good percentage of both adults and children would not be bothered with such fare. The fault is not with them, but with us.

The time has come for us to consider whether we could afford not to influence and motivate the child who is to inherit the world from us. Can the question of a healthy and balanced world environment for tomorrow be left to chance? And, if we should decide to launch programmes to motivate the children of today, what form should they take, and would these young minds be good subjects?

Chairman, Earth Day Observance and Planetary Citizens' Council, Singapore.

Psychologists and child development experts have found that even as early as one year, some babies are capable of comforting others in distress or pain. Before the age of two or three, some children display even more 'sophisticated altruistic behaviour". It became clear that some children stood out for their compassion and their willingness to help others. These findings seem to be contrary to the studies of researchers like Piaget who, perhaps, have over-emphasized the egocentricity of young children. It is known that Freudians, too, have begun to revise their calculations for the appearance of the Oepidus complex and the superego in children.

Child education and development fall into two distinct areas: in school and, outside school. Development of the child's mind and intellect are totally in the hands of the teacher. Feeney, Phelps and Stanfield of the Early School and the University of Hawaii have made certain observations in a recent study: (a) when a teacher is not careful to maintain consistency between actions and philosophy, results may be achieved which were not planned for and possibly not desired. (b) Children tend to do what adults do regardless of what they say. Consequently, the behaviour that the teacher models in the class room is very important. Experience have demonstrated that children can learn either aggressive tendencies or cooperative behaviour through teacher modelling, and, that children who observe adults in problem-solving tasks are able to solve problems more readily than those who have not had the observational experience, and that the level of thinking expressed in teacher statements serves to set the level for student thinking.

Our task is not only to develop socially valued behaviour in children, but also children who can appreciate and understand our environmental problems as such. It is beyond the scope of this paper to discuss the roles schools can play environmental education. We are concerned here with the suitable programmes and incentives that we could initiate and maintain as useful educational tools in the bringing up of new generations of young citizens with the knowledge, conscience and motivation to strive and work for a healthy and livable environment. While we want to mould and create new generations of concerned and active citizens, we must be careful not to breed anti-technology fanatics and decadent freaks. We want children to grow up as enlightened, responsible and progressive individuals with the vision and the courage to build a better and unsinkable world.

Programmes and projects that we must think of implementing for children outside school could include the following:

1. Science-fiction short stories and comics

2. Environmental games and toys
3. Cartoon and documentary films specially designed for children
4. Anti-Pollution badges, T-shirts, caps, etc.
5. UNEP Children's Environmental Protection Awards and Certificates.

(1) Science-fiction short stories and comic books for children could be written and sold in the bookshops all over the world. Children's books are always in demand. We must have national and regional educational centres to encourage writers to submit their manuscripts for assessment. All centres should be working side by side with the Environmental Education and Training Unit of the UNEP in Nairobi. The Unit itself may have to be re-organised and expanded to embrace the above programmes and projects. Authors and potential writers must be given the incentives to write environmental science-fiction and adventure stories for children. In such stories, the writers must use his powers of imagination after perusing the scientific and technical details of each type of environmental problems from UNEP annual State of the World Environment reports, newsletters and books. A science-fiction story could depict the state of the environment in a distant time, five hundred or a thousand years from now: imagine the very high temperatures and radiations from the sun resulting from the depletion of the ozone belt in the stratosphere. Imagine the natural vegetation on the planet being completely scorched and wiped out; imagine the ultraviolet radiation from the sun affecting both plant and human cells resulting in stunted human species; imagine the earth without a drop of oil and the stark dependence on solar energy, etc. Catastrophic environmental conditions can be projected into the future through the media of these stories to heighten the awareness of children. The Seminar ought to take concrete steps towards implementing this project which may be rewarding in every way. Perhaps, a committee and a children's environmental education fund should be set up jointly by the UNEP, UNESCO and the NGOs.

(2) Environmental Games and Toys: There can be indoor and outdoor games. Chlidren could be playing with environmental games like they were playing Monopoly, which is a children's game known throughout the world. The human mind is very fertile: given the incentives, we may have games devised by creative individuals for children of all ages. A committee should, perhaps, be formed to look into the question of 'games for children'.

(3) Cartoons and documentary films on the environment could be undertaken and produce by UNEP and other well-funded bodies or

committees. Cartoon on various environmental topics could be created by a professional staff on a voluntary or honorary basis. A good story writer could easily think up stories on children and the fight to preserve our environment, e.g., story of how a boy saved a city from water poisoning; story of how a group of boys saved a polluted and dead river; story of how wonder boy killed the polluting dragon; etc.

(4) and (5) could be undertaken by UNEP with the cooperation of all NGOs. Selling UNEP or AES anti-pollution T-shirts, badges, caps, etc. could be a way to raise funds for various UNEP and NGO projects and conferences. The UNEP should also consider awarding its certificates, travel vouchers, etc. to youths who had been very outstanding in anti-pollution, energy-saving, or other environmental activities.

The human environment concerns one and all,—from the administrators and the academicians to the technologists and the businesmen; from community and civic organisations to youth groups and the man in the street who form the main target groups of this International Conference on Environmental Education. However, NGOs the world over can play a significant role in alleviating some of the world's most pressing and chronic environmental problems. It is not enough that governments and their agencies act and interact with UNEP; it is not enough that reports and surveys be written and publicity given. There must be action,—action by both governmental and non-governmental organisations (NGOs) together with UNEP. But, for their actions to be effective and sustained, NGOs must first of all identify the priorities and not be confused and discouraged by the magnitude of the task; secondly, their efforts must be coordinated and concerted.

Summary

In the past, insufficient attention has been given to the environmental education of children in schools. This mistake should be corrected if we are to bring up new generations of enlightened and motivated citizens who would strive and work for a healthy, balanced and progressive world. In the process of educating and exhorting, however, we must be careful not to breed a generation of anti-technology and antigrowth fanatics. Children are known to be caring even as young as one year-old. Hence, it is possible to teach children to be responsible and constructive in matters of public interest when they go to school after learning to read and write. UNEP and the various environmental bodies throughout the world should come together and plan for the implementation of various programmes and projects that could be adopted inside and outside the school to influence and educate the children in environmental matters albeit in the simplest terms. Some projects, as outlined in this paper, may need initial funding and a pool of creative and dedicated workers. But, eventually and in due course, these projects and all the efforts put into them would not only pay for themselves, but also generate income for the movement. The environmental education of our youths throughout the Free World should be a great challenge for us: it is through these young citizens that the hope for a better and saner world lies. This Conference ought to guide the NGOs to coordinate worldwide action.

The Development and Activities Environmental NGO's in Indonesia

BEDJO RAHARDJO[*]

For instance, many factories and industries have sprung up recently, which demonstrates an advanced technology, but they bring disadvantages in that the soil and water are widely polluted by industrial effluent.

In answer to this situation, many organisations have been formed which are concerned about these developments and ready to combat environmental deterioration brought about by the people themselves through ignorance or as the result of un-ecological industrial activities. These NGOs try to raise the level of environmental awareness in the community.

The history of environmental NGOs in Indonesia started a long time before the Ministry of State for Development Supervision and the Environment was set up under Prof. Dr. Emil Salim in 1978. These environmental NGOs can be put roughly into 5 categories according to the scope of their activities:

> 1. Nature lover groups, 2. Professional organisations, and 3. Hobby groups, 4. Community Development Organizations both in Rural and Urban area. I shall give a few examples of the activities of individual groups: The South Jakarta Youth Group has co-ordinated many public awareness campaigns of talks and slide-shows about the environment supplemented by field-trips, while nature lover groups often combine their camping activities with programmes such as planting trees for shade and soil protection, and giving talks in villages. The Biological Science Club has carried out scientific research in several areas, and the Indonesian Birdwatching Association has studied the behaviour and distribution of various species of birds, and the best way of protecting them.

---

[*] Secretary of The Group of Ten for The Environmental, Indonesia.

The Development and Activities of Environmental NGO's In Indonesia

With a surface area of 61,000 sq. km, Indonesia lies between 6° North and 11° South of the Equator. It consists of 13,000 islands united by the Indonesian Ocean, and has two seasons, with the west monsoon bringing the rains and the east monsoon bringing the dry season.

The Indonesian archipelago is very rich in natural resources such as forests, a fertile soil, water and minerals, and as the population of 147 million increases, so too does pressure on these resources. The forests are thinned down, the land becomes more barren, and in many places flooding, landslides and erosion occur, bird song is rarely heard, and arid lands and coarse grassy areas expand while the towns and villages become fuller and dirtier.

In East Sumatra, the elephants wander into transmigrant settlement areas and trample crops, in West Sumatra, elephants and tigers run amok and attack people, while in Central Java, fish are affected by disease. These are some of the unfortunate consequences of the disturbed interaction between man and wildlife in Indonesia.

There are striking differences between Indonesia nowadays and the Indonesia of 20 years ago. The most important changes have been brought about through development programmes, but while on the one hand development can mean progress and a better standard of living, on the other it can bring about unforeseen changes in the environment which threaten wildlife and mankind.

However, the efforts of individual groups working alone can achieve very little. It is important to give NGOs a much more prominent role, and it was felt that this could be done by increasing communication and co-ordination between the groups. The lack of available information on the development of the environment and the difficulty in obtaining funds and training opportunities were felt more and more as major obstacles by NGOs. Perhaps a forum for exchanging ideas and information would help to overcome these problems, and with this in mind, the Association for the Conservation of the Indonesian Environment invited several organisations to a meeting in Jakarta in May 1978. It was decided at this meeting to establish the Group of Ten for the Development of the Environment as a communication forum and as a means of bridging the gap between government and people. There are now 19 member organisations of the Group of Ten although originally there were only 10.

The formation of the Group of Ten was supported by the Ministry of State for Development Supervision and the Environment and by the Governor of Jakarta, and it was hoped that through this new organisation NGOs would be able to play a role in decision-making on matters concerning the environment.

The Group of Ten encourages and guides co-operation between its members and other parties, such as governmental or private institutions, and it collects and disseminates ideas relating to the development of the environment in its broadest sense. Member organisations of the Group of Ten are active in several fields. There are conservation education groups such as the Green Indonesia Foundation which publishes a magazine for schools and gives lectures and slide-shows on the environment to the general public and to high-schools in particular.

The Consumers' Association and the Association of Indonesian Architects together set up a big environmental exhibition. An environmental poster competition was organized by the Association for Journalists in Science and Technology, and anti-litter campaigns have been carrried out by the Conservation Fundation and the Gardens and Environment group. Industrial pollution has been monitored by the Village Planning Organisation in Central Java, and the Study Group for Environmental Pollution and the Biological Science Club investigated pollution in the rivers flowing into the Bay of Jakarta and the Bay itself.

However, even after the Group of Ten had been in existence for 2 years it was felt that environmental activities still lacked co-ordination. The Group of Ten, therefore, organised a meeting, the needs and spheres of activities of NOGs were formulated, and a co-ordinating body called the Indonesian Environmental Forum (IEF) was set up to channel the activities of NGOs into a national context and above all to emphasise the need to increase public awarenees campaigns and environmental education.

Basically, the IEF functions in 3 fields: (a) compiling and disseminating information and acting as a channel of communication between NOGs, (b) complementing formal and non-formal education programmes, and (c) helping the NGOs to upgrade their own programmes.

The IEF has put into effect several programmes in the field of communication and information, for example publication of a monthly bulletin, collection of information from nature lover groups and research expeditions such as "Operation Drake" and dissemination of the information on NGOs.

It encourages artists keen to work for the environment by organising activities such as an evening of song, poetry and comedy on the theme of the Environment, it ran a poster competition through a popular women's magazine, and it makes broadcasts on TV and radio.

The IEF also organises lectures and discussions led by experts or simply between NGOs to exchange information, and it has provided a lot of information to the government on conservation issues such as the endangering of orchids in West Irian because of tree-felling and on the trade in protected species of animals. Representatives of the IEF are involved in giving technical advice to the Ministry of State for Development Supervision and the Environment, which is important as a may for NGOs to bring to the forum important matters which way previously have been overlooked. A three-way education process in Indonesia, namely between the Government, the IEF and the NGOs is vital if the younger generation should understand and become involved in nature conservation. In the year 1980-1981, IEF held four 5-day workshops in Java with sessions on: Why conservation is necessary; Different types of ecosystems; The necessity of preserving a rich flora and fauna; The conflict between development and conservation; Family planning and health and Wildlife photography. Each of them was attended by 30-40 people, and a fifth is planned to take place in West Sumatra in December 1981. We believe that it is essential to improve educational materials all the time, and with this in mind the IEF has looked for sponsorship from the private sector in Indonesia, which too has a responsibility towards the environment.

As result of this, BAT Indonesia has set up a Conservation Education Fund to be administered by the IEF.

Conservation education is expanding in all regions of Indonesia, and although the general principles are applicable everywhere, specific programmes really need to be developed for each geographical area in Indonesia, as each has its own environmental characteristics. It is hoped that the workshops in Conservation Education will go a long way towards creating different approaches in different areas.

The IEF is also involved in practical appropriate technology programmes such as introducing energy-efficient stoves and biogas plants in rural communities, as part of the effort to create an energy-conscious attitude in the villages. Members of the IEF have also participated in workshops on waste--recycling techniques.

To help NOGs develop their activities in their own particular field of interest, the IEF tries to provide necessary facilities and materials, or delegates the responsibility for implementation of a particular programme to a certain group. For example, the IEF no longer fulfills all requests for talks on the environment itself, but passes the request on to an appropriate organisation. It brings together different organisations with individual resources of money expertise and technology so that they can pool their resources and implement a programme together. This was done for the Ciliwung River "Clean Water" programme in Jakarta, which the Biological Science Club and Women's Groups worked on together successfully.

In conclusion, we can say that environmental problems in Indonesia are on the increase, and that this trend is paralleled by the growth of environmental NGOs. These groups are playing a more important role in decision-making, especially through the Indonesian Environmental Forum. The healthy working relationship between NGOs, the IEF, and the government must be consolidated so that the aims of conservation can be achieved, particularly through education.

Ten Years After Stockholm Since 1972 in Japan

JUN UI*

Along the rapid economic growth unprecedent in the world history in 1960s in Japan, Japanese environment was also rapidly destroyed. Kogai, which meant public damage, became a common word in daily conversation. The damage was not only on material, but also on the health of people, and even many lives were lost by heavy pollution like Minamata disease, Itai-itai disease, asthma, etc. In the latter half of 1960s the damage became so heavy, that the victims of pollution had to rise up for the protest and resistance, and their self-help movement became one of the most serious domestic issues in Japan. Two successive Minamata disease cases, Itai-itai disease (Cadmium poisoning), Yokkaichi asthma, all became court cases asking for the clarification of cause-effect relationship, the settlement of polluter's responsibility, and the compensation of polluted damage in the end of sixties. Dissent movement of youth and students also helped to promote the victims movement.

Especially in 1970, the discovery of photochemical smog in Tokyo, and of lead pollution from automobile exhaust gas, brought out new phase in pollution issues. Before that time, pollution was rather regarded as remote, isolated problem among poor fishermen and farmers in countryside, by most intellectuals and citizens in town. But the news of photochemical smog and other pollution became suddenly serious own problems for city dwellers. Public opinion started to boil up, propagated by mass media, and even reluctant central government had to do something to pacify the public opinion. Some dozen laws were prepared and Environmental Agency was established, collecting formerly dispersed sections on the environment in various parts of the government. Public opinion supported this move, and as a new small office in the government, Environmental Agency had to co-operate actively with people's movement and public opinion for its identification and survival. With the pressure of public opinion, also the industry had to spare some part of the profit for the investment of pollution control. Several industrialization projects were cancelled or considerably modified by the resistance of people, fearing pollution in future.

*University of Tokyo, Tokyo, Japan.

Stockholm UN Conference was held at the peak of this rapid economic growth in Japan. In spite of visible and invisible resistance in the government and industry, the proposal to send a delegate of pollution victims to NGO conference in Stockholm, was supported widely by public opinion, and the mission was quite successful to show the real backside of economic growth to the world. It was a people's reflection on the economic growth which seemed limitless and on the expansion of consumption level.

Until Stockholm UN Conference, Japanese grassroot movement had little sense in the international viewpoint of the problem. Mostly its sight was limited within domestic issues, because the damage was so severe, and to fight against the immediate pollution was the limit of its capability. Little was known on the role and position of Japan in world society, among common people in Japan. 72 Stockholm was the first chance to convey the reality of Japanese pollution to the outer world in a systematic way. Since that time, a new viewpoint to see Japanese situation within the framework of international relation started. To show own failure frankly, was not easy for many Japanese, but through that action, to prevent the repetition of same failure elsewhere, the publication of KOGAI-Newsletter was started since 1973. Concurrently, the capital export of polluting industry, so called pollution expert, was noticed by various movements, and a movement to stop it started.

The oil crisis in the end of 1973 was the announcement of the end of Japanese rapid economic growth period. Readjustment of industrialization plan was tried in the government and the industry, to adapt to new situation. For the industry, to reduce the investment in the indirect division which did not contribute to the production, was an urgent necessity, and for this purpose, a move to make looser environmental limitation and standard started. In 1975, on the control level of automobile exhaust, a sharp conflict occurred between public opinion and the interest of giant car makers, but it was solved by technical effort in small makers and pressure of public opinion asking cleaner air. In this case, technology followed to the demand of public opinion. On the other hand, steel industry and automobile industry cooperated for long time to exert pressure to the government and Environmental Agency for looser ambient standard, and finally successful to change NOx standard from 0.02 PPM to 0.06 PPM, threefold looser in 1978. Environmental Agency also yielded to the pressure from the industry, which has been the powerful sponsor of the conservative government for long time, and refused the cooperation with grassroot movements. As a small, politically weak agency in the government, this change meant to cut off the tie to the supporting power, its influence decreased. Nomination of minister was changed from liberal to reactional, to less influential politician. Finally, some argued to demolish the agency.

If there were no resistance by grass root local movement by people in the first half of seventies, the size of Japanese industry could be much larger, then resultant economic confusion should be much larger after 1973 oil crisis. This resistance to the industrialization was, in fact a stabilizing factor for Japanese economy. Japanese government and industry, however, did not consider the resistance in that way, and chose the way to depress it by money and power. Application of police power to the movement became common in the issues of nuclear power plants, crude oil storage sites, nuclear fuel reprocessing factory site, large scale sewage treatment plants, and airports. After rising living standard by rapid economic growth, and anticipating unrest in future in the end of seventies, a kind of conservatism to protect the material property by power, got momentum in Japan. Protectionism of national interest, and expansion of armament became louder policy in political argument. Meanwhile, to keep economic prosperity, public finance investment was kept in high level with loan policy, and for its distribution to local economy, the initiative in the central government was remarkably increased. This economic policy also increased the influence of large industry in domestic politics of Japan.

Increasing conservatism in 1980 election and following armament expansionism in recent Japan, is an expression of effort to maintain economic growth policy by power within a finite world market. This tendency, to protect present interest by power, to infest nature and human society to get more profit, will continue for the time being, until to reach a complete bankruptcy in some future. Within a finite limit of resources and capital, the effort to push forward this limit by power will continue for the moment, because this situation is a quite new one for Japanese capitalism. A strong power policy to push forward to build energy consuming nuclear power plant is typical move on this direction.

The position of mass media in Japan is, more or less delicate and complicated, situating between public opinion and commercialism. The proportion of governmental public relation, cannot be ignored in the commercialism, because of its large fund. There are always hidden struggles and balance of powers between the humanistic effort of reporters and the commercial will of the management of the media in continuous conflict in most media in Japan. It is quite difficult to anticipate the move of media, but at least we have to know this delicate balance of power and have to be careful to approach it.

From the viewpoint of grassroot movements, the present tendency is a formation of loose network without fixed national center, enough knowing this is not the fastest way to achieve the target. We had bad experience in past in anti-nuclear movement, which was once powerful, but its headquarter was occupied by political parties and divided into three factions and list its momentum since 1963. Not having center is favourable for not getting attack in the center. For the moment, grassroot movement will go on this way, making here and there some information cells, keeping loose coordination. Their main issues are concentrating now into energy and large scale public investment. The statement of the movements, and their mode of action is, the reflection on the affluence which became inherent in Japan during the process of rapid econmic growth in sixties and seventies, and the investigation of an alternative way of life. In fact, with resistance and negative participation, still many projects are modified or improved during the process of arguments. Recently, there are some cases for the proposal of alternatives. This increase of participation in positive or negative way, is a refusal of experts society, increasing request of local autonomy, and the respect for variety and diversity. This is a quite new experience for Japanese, who were accustomed for centuries to Asian agrarian society without knowing the process and the target of the society. Since 1970 Jishu-Koza has been continuing its activity as a knot of such network and citizens' self-educating organization. Such self-study action is quite common among the movements, for example, detection of air pollution by copper coin and moss, radiation l[illegible]ction by spiderworrt, etc.

In short, summarizing ten years after Stockholm in Japan, it is initially advancing, then retreating environmental policy in the central government, some gradual progress in local government, qualitative change in local people's movements. For the grassroots movements, it is new move to internationalism, decentralization, self-help, alternative life-style, harmony of human right and tradition, etc. This is a challenging new task for Japanese people.

Environmental Education in Malaysia A Decade Since Stockholm

T. CHELLIAH*

The conscious awareness of the essential role of environmental education as an integral part of the Malaysian educational process is a fairly recent and an almost post-Stockholm conference development. Like several other countries of the Third World, Malaysia's immediate post-independence period was devoted to fulfilling the need for real per capita growth, greater economic strength and stability through exploitation of natural and mineral resources, and rapid urbanization. The 1960s, a period of general indifference to the potential dangers posed by massive development, witnessed the beginnings of environmental deterioration through indiscriminate logging soil erosion, river pollution and industrial pollution. The level of consciousness demonstrated on the matter was remarkably low; the government had devised no strategy to contain an inevitable problem on its hands, a point well illustrated by the glaring absence of any environmental concerns expressed in the First and Second Malaysia Plans (1966-1970, 1971-1975); the public too remained silent, ill informed as they were on environmental problems and passive observers of the development scene unfolding before them. The mass media highlighted the tremendous pace of development projects but hardly the consequent problems of industrial pollution, unplanned logging methods that was threatening the country with extensive deforestation and soil erosion. The commercial sector of the economy was on a reckless profit maximization exercise e.g., over-fishing which resulted from the indiscriminate issue of trawler liscence, wide spread mining of tin, opening up of land development schemes. There were no environmental impact assessment studies that could have indicated the extent of danger being faced from environmental degradation and the consequent necessity to remain vigilant of the results of development policies. If a firm policy had been adopted in the 1960s to balance rapid economic growth with the conservation of the environment, if government and private sector development had been regulated by strictly enforced legislative ordinances related to soil, water, flora and fauna, mineral exploitation and land development schemes, many of the problems that the country had to face later could have been eased, even if they were unavoidable. As it turned out, the 1970s experienced the cumulative increase of the strain on the environment.

---

*Faculty of Education, University of Malaya, Kuala Lumpur, Malaysia.

It was in about the mid-1970s that the issue of environmental protection gained its first major examination, both as an aspect of government policy and as a matter of public concern. There are two developments that explain the beginnings of the new consciousness on environmental matters.

The first was the findings of the 1972 Stockholm Conference on the Human Environment which recommended that the Secretary General, the organization of the United Nations system, especially UNESCO, and the other international agencies concerned, should, after consultation and agreement, "take the necessary steps to establish an international programme in environmental education, interdisciplinary in approach, in school and out-of-school, encompassing all levels of education and directed towards the general public, in particular the ordinary citizen living in rural and urban areas, youth adult alike, with a view to educating him as to the simple steps he might take, within his means, to manage and control his environment". This recommendation emphasised the need for all nations to take cognizance of their environmental situation, not only in preparation for a World Inter-governmental Conference but also to understand the reality of the situation in their own countries.

A second factor that might be considered to have been influential in arriving at an environmental policy is public awakening to the need for adequate safeguards to the quality of their lives. Much of the public consciousness on the subject can be attributed to the work of a number of voluntary organizations that devoted considerable time and energy to championing the cause of environmental protection. These societies began to highlight the over use of natural resources, indiscriminate industrial and technological policies that had led to crisis situations in specific instances, inadequate laws of the ineffective enforcement of legislative controls. They illustrated the manner in which the physical and psychological health of the people have been affected, and the extent to which the economies of river-bank based rural population had suffered from the pollution of the rivers where the poorest groups fished for a living, not to mention the deteriorating quality of life in the urban areas. It became quite clear that unless decisive and early action was introduced by the government, the country will be heading towards a disastrous environmental future.

The increasing consciousness was to result in the formulation and implementation of some positive steps on the part of the government and the public to improve the declining quality of the environment. The fact was recognized for the first time in the foreword to the government's Mid-Term Review of the Second Malaysian Plan which stated that

> the emerging problems associated with rapid development will require equal attention. One such challenge is the management of the environment. The Outline Perspective Plan stresses the importance of industrialisation for the country. Yet we also know the environmental costs of industrialisation and urbanisation. We must therefore evolve appropriate policies and programmes so that accelerated industrial development goes hand in hand with sound management of our environment.[1]

It is evident from the statement made by the Prime Minister himself, that the government had begun to consider granting high priority to environmental protection as a vital aspect of development strategy.

Environmental consciousness in the country reached a climax in 1974 when the "Environmental Quality Act" was legislated. This Act clearly defined the government's position on environmental management and substance to the recognition that Environmental protection was as important as economic development, for both were designed to bring about a better quality of life for all. This legislation has subsequently enabled the government to deal with a broad spectrum of problems ranging from noise, industrial wastes, wildlife and vegetation, oil slicks at sea and the poisioonus fumes of vehicles. The Environmental Quality Act will be used in conjunction with other legislations as an important instrument of environmental management. The legislation is designed in such a way that the government can act or intervene in any environmental crisis.

In 1975, a Division of Environment was established in the Ministry of Science and Technology to enable effective coordination of other agencies, Federal or State, connected with environmental protection activities. The establishment of this Division further reinforced the government's serious desire to combat the environmental crisis.

The Third Malaysian Plan also outlined a National Environmental Policy, reflecting the increasing official concern and commitment of the government to environment. The Third Plan underscored the objective of keeping balance economic development and environmental conservation, so that the benefits of development are not negated by the costs of environmental damage[2]. This plan also examined the environmental effects of development and the policies and programmes required for environmental management and protection, as well as the enforcement required for the legislation to have any meaningful effect.

The Environmental Impact Assessment was another logical step toward that direction of ensuring the maintenance of environmental quality. The policy stipulated the evaluation of all relevant projects and the understanding of an assessment of the overall impact of these projects on the environment. Ministries and departments as well as the private sector were required, before embarking on the implementation of any project, to identify all likely environmental effects as well as the means to be taken to counter them[3].

Another area where the increasing official concern of the importance of the environmental protection could be discerned was in the field of legislation. After the passage of the Environmental Quality Act in 1974, many other regulations followed to further ensure the successful abatement of pollution and other environmental problems. Some of these regulations are the Environment Quality (Prescribed Premises) (Crude Palm Oil) Regulation 1977, Environmental Quality (Clean Air) Regulations 1978, Environmental Quality (Prescribed Premises) (Raw Natural Rubber) Regulations 1978, Environmental Quality (Sewage and Industrial Effluents) Regulations 1979 and The Motor Vehicles (Control of Smoke and Gas Emission) Rules 1974.

It is very evident from the various laws, policies and programmes pertaining to environment that the government began to be seriously committed to cause of environmental protection, and since then the level of environmental consciousness has been high at official levels.

Environmental Education: Primary and Secondary Schools

Curriculum renewal in Malaysia has followed closely the development plans of the country. All four development plans have stressed the role of education in national development and national integration and the need for manpower development. The Third Malaysian Plan recognised that:

> Effective management of the environment requires not only technical capability but also full awareness on the part of the population at large as to the measures required for the purpose. The mass media and educational institutions will be used to stimu-

late awareness among the general public of the importance of environmental conservation and the social and economic rationale affecting decisions on environmental issues. At the same time, technical training for personnel invalued in environmental management. Scientific analysis of natural resource management and the economics of the environment will be expanded.[5]

In 1974 a cabinet committee set up by the government to study the implementation of the national education policy—recommended that primary education should focus on general education and basic skills, namely the 3R's the total development of the child, the balance between school, home and community and help the child understand himself and his surrounding

Malaysia is currently in the process of translating the recommendations of the Cabinet Committee Report into education programmes. Its implementation is scheduled for 1982 on a trial basis and national implementation is planned for 1983. The philosophy underlying the new approach is that in the first three years of primary education, the child is aided in the development of basic skills of the 3R's, subsumed under the umbrella subject area namely Environment and Man. The content has been carefully designed to include an understanding of geography, civics, history, health, art, music. The entire curriculum is built around six themes which are extended in scope and depth from year to year for the first three years, and for the following three years the subjects will be taught as disciplines. The six themes are:

> man (child) and his environment (awareness of surrounding), interaction among man (human relations), interaction of man with his environment, interaction of the elements in the environment, issues related to man and the environment.

At the secondary and [illegible] school certificate levels, subjects taught are the sciences and the humanities. An examination of the subjects and syllabi reveals the existence of numerous topics which have direct or indirect bearings on environmental issues. This should not tempt the conclusion that environmental education is already being taught in schools; rather it illustrates that opportunities do exist for its inclusion. Unfortunately however, owing to constraints (such as a monotext approach to teaching, and learning, coupled with the government textbook loan scheme) there has evolved the creation of a 'single text-book culture' with resistence to any form of methodological innovation. The emphasis placed on academic excellence in examinations is a factor that resists any attempt at liberal education. The overcrowding of content and subjects is another constraint that causes barriers to the introduction of environmentally related concepts. However efforts have not been spared in an attempt to infuse and integrate environmental concepts into the existing subjects. The integrated science taught at the lower secondary level attempts to break down barriers to compartmentalization and enhances the holistic approaches to learning.

Teacher Training

In planning for the change from a two-year teacher training programme to a three-year programme implementated in1980 curriculum planners have taken the opportunity to include at every opportunity environment related concepts, to create an awareness among the trainee teachers of the impact of environment and to sensitise them to opportunities in the teaching-learning process by which they could impart such information. For example in the Health Education curriculum, one out of the five topics is Man and his Environment.

At the Faculty of Education, University of Malaya, a course is run specifically to train teachers with either a science or humanities back ground to teach environmental education. The objective of the programme is to develop and interdisciplinary course which does away with the traditional boundaries between the various disciplines. The objective of the course is to provide students with a clear perspective of the environment, to enable them to understand the fundamental problems of the environment in relation to development and society, what science and scientist can do about the environment and how the sciences, humanities, environment and society interact. The general aim is to discuss selected issues and problems which are not excessively scientific but which are nevertheless thought provoking within the context of the various undergraduate subjects background of the teacher trainees. The expectation is that this approach will provide a learning experience which would instill in them and their future pupils an interest in the subject and an ability to keep abreast of environmental issues[6].

School Related Activities

In-service courses for teachers conducted by the relevant departments of the Ministry of Education at national and regional levels are aimed at exposing teachers to new developments in curriculum and teaching. Environmental education is one topic which has gained prominence in these programmes. The Curriculum Development Centre of the Ministry has developed a self-instructional module for teachers. The module higlights environmental issues through population education, such as population and environment, population and resources, population and the quality of life. Senior science teachers have also been afforded opportunities to attend courses at the field study station on environment and ecology.

Environmental Education: Tertiary Level

The concept of environmental education as an integral and systematic tool of scientific inquiry received little attention in the formulation of the curricula in tertiary institutions of learning in Malaysia until the last decade This was by no means due to any conscious apprehensions about the value or appropriateness of the subject in the construction of teaching and research programmes. Indeed, references occasionally alluded to environmental issues in the teaching of certain courses, and were somewhat manifest in the publications of the teaching staff. But in general, the notion of providing central focus to environmental matters, or in structuring courses to deal with such matters in a fairly organic method, remained by large a novelty. The reasons that explain the relative paucity of serious interest in developing environmental education until recent times could be attributed to the following factors.

In the first place, there was no major stimulus provided by the federal government to the institutions of higher learning to pursue an active programme of teaching in environmental education for the scientists, engineers and other categories of decision makers which the universities produced. This was due fundamentally to the fact earlier stressed—that Malaysia, since Independence in 1957, had channelled most of its energy and concern to the immediate need of increasing the momentum of economic development.

In the absence of any pressing demands made by the government on the need for the higher institutions of learning (that it funded) to produce manpower skilled in assessing environmental requirements for development, the universities took little initiative to work out specific programmes designed to offer environmental education as a regular course of study.

In the second place, it was not until lately that the universities in the country ventured in any significant manner to broaden the methodology of its teaching to include interdisciplinary studies, the foundation for the development of environmental education. This was not the result of a conscious indifference to interdisciplinary methods of inquiry; rather, it followed from a predetermined British model that stressed the uniqueness of each discipline. The aspects of purity and theory received greater stress than their applicability to the other disciplines. The oldest university in the country, the University of Malaya kept by and large to its objective, declared or otherwise, to the production of scientists and humanists to staff the public and private sectors of the economy. In that sense it fulfilled the immediate demands of the day, and the need at that point in time did not include the supply of environmentalists skilled in sophisticated interdisciplinary methodologies. Research, too, tended to follow the pattern of interest in undergraduate training, though to be sure there were staff members and researchers who included some environmental concerns in their writings. But there was no school of environmentalists, as it were, emerging in the universities in any form of identifiable fashion until the last decade.

The only university that devoted itself almost wholly to interdisciplinary programmes of teaching and research at all centres is University Sains Malaysia, but again that University was only established in 1969, and with the intention of developing fields of study that had yet to be exploited. However, since its inception, the university has maintained a multidisciplinary approach to teaching and research and organized itself into a 'school' system, with priority being given to research of an applied nature (whilst encouraging pure or basic research according to the availability of financial support).

In the 1970s, however, perceptible changes began to influence the nature of courses that were offered in other Malaysian universities; these factors encouraged a review of teaching and research interests in favour of including environmental studies in one form or another. The major factors that explains this new development might be stated as follows.

The government was alerted to the need to study and evaluate the impact of the changes wrought by economic development on the natural human and ecological condition. In a country that had for nearly two decades altered the physical landscape through the continual clearning of forests to pave the way for gigantic human settlement schemes, the digging up of the ground for mineral exploration, the setting up of manufacturing industries which filled the air with smoke, and such like, the conscious concern was to establish a balance between economic development and environmental needs. Planning and development, it became clear, needed the incorporation of environmental considerations, and this was reflected as a matter of government policy for the first time with the publication of the Third Malaysia Plan (1976-1980) which stated *inter alia* the following as part of the strategy for policy:[7]

1. the impact that population growth and man's activities in resource development, industrialization and urbanization have on the environment;
2. the critical importance of maintaining the quality of the environment relative to the needs of the population, particularly in regard to the productive capacity of the country's land resources in agriculture, forestry and water;
3. the need to maintain a healthy environment for human habitation;
4. the need to preserve the country's unique and diverse natural heritage, all of which contribute to the quality of life; and
5. the interdependence of social, cultural, economic, biological and physical factors in determining the ecology of man.

It was further declared that at the same time, technical training for personnel involved in environmental management, scientific analysis of natural resource management and the economics of the environment will be expanded. The plan mentioned, for the first time, the value of environmental education as an aspect of government policy. Earlier in 1975, Malaysia had participated in the questionnaire entitled "Assessment of Resources for Environmental Education: Needs and Priorities for Member States" issued by UNESCO in cooperation with the United Nations Environmental Programme. The objective of the questionnaire survey was to assess the priorities and needs in environmental education which would be useful for educational decision makers as a primary source of information for the formulation of national, regional and international action in environmental education. Although the information provided did not necessarily represent the final opinion of the countries that participated in the exercise or their official statements on the matter, Malaysia's reply did indicate that it attached high priority to the development of personnel at pre-school and primary educational levels, the development of organizational support at primary level and the provision of physical facilities at tertiary levels.

The universities responded in the 1970s to the new climate of opinion that was gaining paramountcy, both within and outside the country. From the unobstructive ripples it first set in motion in Malaysian academic concerns, the study of the environment began to demonstrate the potential of developing a wave, holding forth the promise of some great magnitude for future directions in teaching and research. A beginning was made, however humble, to overcome the clinical compartmentalization of the sciences in favour of arriving at a wholly different perspective that placed the reality of human and animal habitat as one of the new focuses of the sciences. And in the humanities and social sciences, a new wave of interest began to influence teaching, research and the application of science and technology to economic development.

It should not be concluded from this however that environmental education has reached or is likely to soon reach the stage of maturity; on the other hand, the development that is taking place is still very much nascent. Given the relative youth of environmental education worldwide, staff members trained in single disciplines are only just moving into interdisciplinary studies in order to better equip themselves with those academic skills required for a proper appreciation of the problems of environmental research and teaching. Time is required to initiate teaching in an area that had hitherto been neglected and for appropriate resource materials to be developed. The latter involves such considerations as audiovisuals aids, the determination of the use of the resources of the environment itself as suitable instructional aids, collaboration with others for the production of educational materials, the design of formulae for either developing environmental education as a subject in its own right and leading to a degree or the incorporation, in stages, of environmental education into a teaching programme which will involve changes in the content of subjects taught, the training of new personnel or environment educators, funds to support practical field work for students to render the teaching pragmatic, relevant and effective.

An impressive beginning is however currently underway in the universities to include in their teaching and research programmes studies relating to interaction of man and his environment, taking into cognizance the biological, ecological, social and economic aspects. The future of environmental teaching programmes, as envisioned in many university departments in the country, would include a broadening of the area of studies and instruction to take account of the social and behavioural sciences. There is equally a recognition of the need to train not only highly specialized environmental specialists but also to develop programmes for the training of environmental generalists who would be in a position to effectively coordinate the activities of specialists.

What is, however, not quite clear or decisive is the manner in which the universities (other than Universiti Pertanian Malaysia, which has the only fully budgeted centre, the Faculty of Environmental studies) will structure their environmental education courses; there are at the moment differences in perceptions reflecting the experimental stage of environmental education programmes.

At the University Kebangsaan Malaysia science faculty, there are proposals being initiated for an inter-departmental environmental science centre; under this structure it is hoped to divide the content of environmental education between relevant departments of study. The aim of the centre is to develop studies and programmes in Environmental Sciences in order to develop skills and manpower to monitor and control environmentally related problems and to plan and implement appropriate programmes.

The focus for teaching will be on various aspects of industry, chemistry and biology; the course of study will be based on the pure and applied sciences with elective options from the field of environmental sciences such as ecology, natural resources, society and environment, development, control, recycling of wastes and engineering processes.

At the University of Malaya's Institute of Advanced Research, the approach is in the form of coordinated management of interdisciplinary research in which the programmes for environmental sciences will assume the nature of a project. The project will be worked upon by staff members in various faculty departments on behalf of the Institute. As the Institute does not currently have its own faculty, nor even a permanent staff of full time researchers, projects such as environment and resource management will be coordinated and funded by the Institute with the research undertaken by staff belonging to other departments using the faculty of those departments. But it is the objective of the university that the recently established Institute will eventually be a fully staffed centre for research with provisions for active research collaboration with all other departments of study.

Environmental Education: Non formal

Efforts to reach the general public and specific target groups* outside the school system and the universities have involved many different instruments—government institutions and agencies and variety of non-governmental organization including private and commercial enterprises. One would conclude that efforts and programmes are sufficient in the country but unfortunately there is an urgency to have these programmes coordinated so that efforts and energy can be maximized.

*Target groups are many and varied ranging from the general public to decision makers. They include various professional groups, out-of-school children and youth, the unemployed and parents. Thus in the message has to reach two general functional groups, namely the policy makers and the general public who experience the result of decision making.

For convenient reference, non-formal environmental activities and education can be classified as government initiated and those that are organized by voluntary organizations.

The Division of Environment can be considered to be the most active government agency in respect to non-formal environmental education. As part of its objective to instill in the people the full awareness of the importance of environmental protection and conservation, the Division of Environment publishes the bilingual magazine *Sekitar*, distributed free to all government departments and organizations, universities, schools, libraries and relevant agencies abroad. Apart from this, the Division of Environment distributes guidelines and explanatory notes relating to specific legislation and holds exhibitions and sets up pedestrian malls for special functions (such as the World Environment Day) at which information, brochures and pamphlets are distributed to the public. It also prints posters, information bulletins and special messages such as the speeches of the Environment Minister, conducts talks and discussions for the general public, government departments and organizations and schools. It further provides help to schools in organizing exhibitions, and takes an active part in radio and television programmes relating to environmental education. Seminars organized by the Division of Environment range from issues in education and legislation to highly technical and scientific sessions relating to pollution and affluent control.

To further intensify its activities, the Division of Environment proposes to set up the Environmental Education and Information Unit to meet with the following objectives:

1. to increase public awareness with regard to the state of the environment pollution and human health,
2. to inculcate the responsibility of controlling and presenting environmental pollution and that of improving the quality of the environment through public education.

The strategies that this unit plans to adopt are:

1. The establishment of effective subprogrammes of activities and provision of facilities for the dissemination of environmental information.
2. The promotion of activities to catalyse national and international information links for the exchange and use of environmental information.

3. The use of existing or planned sources of environmental information and/or information systems.
4. The promotion of efforts though cooperation with other government agencies and relevant organizations/institutions in the field of environmental information.

In order to achieve the above and establish effective implementation it has been proposed that regional offices under the Division of Environment be set up in the Northern Region (Penang), Central Region (Selangor), Southern Region (Johore Bahru), Eastern Region (Kuantan), Sabah (Kota Kinabalu) and Sarawak (Kuching).

Other government bodies active in non-formal environmental education are the Department of Wild Life and National Parks which, in conjunction with the establishment of National Parks and Study Centres, incorporates some form of education; the Town and Country Department and the Local Authorities together with other agencies organize activities such as Tree Planting and Cleanliness Campaigns; the Public Health Institute (Ministry of Health) in their health and sanitation programmes instill some form of Environmental awareness.

The active interest the mass media has exhibited recently (and its response to letters written by concerned citizens) has been encouraging. The press (printed media) has been covering a wide range to topics on environmental issues, conservation and legislation not only as information, interesting weekly feature articles, reports and daily news items, but also editorial pieces which could hardly be missed by the average reader. Occasional articles also do appear in some of the popular magazines.

Local and international programmes over the radio and television have carried information and messages on the environment. The radio, through its several language channels, has not only news bulletins, but talks and discussions. The television through some of its programmes such as 'Focus', 'Scope' and special documentary and other programmes on wild life ("Survival" to name one) has been effective in conveying the message.

There are several non-governmental organizations in the country whose interest in environmental issues and action-orientated programmes are well established and recognized.

The Environmental Protection Society Malaysia, a voluntary body of concerned Malaysians from all walks of life who are anxious about the deterioration of the environment and who feel that citizens must contribute towards preserving the environment, was founded in 1974. Its activities include the organization of forums and talks; issuing press statements; participation in formus conducting studies and research and the publication of a quartely magazine *Alam Sekitar*.

The Malayan Nature Society, with branches in nearly every state in the country, organizes in-door activities in the form of talks, forums, slides and film shows, discussions related to environment and conservation issues talks to school children, and out-door activities such as nature walks, camping and hicking trips. *The Malayan Nature Journal* is a quarterly journal published by the society carrying original and review articles pertaining to the natural history and biology of the Malaysian region. While this bulletin is academic and scientific in nature, a supplement to this journal is the *Malayan Naturalist*, a quarterly newsletter devoted to furthering the objectives of the Malayan Nature Society. The society aims to promote an interest in the natural history and conservation of wild life and natural resources in Malaysia and the surrounding region. It publishes articles directed to the layman on the natural history of the region and includes news and developments in conservation both in the region and world-wide.

The World Wildlife Fund Malaysia with its quarterly Newsletter Conservation Malaysia provides information and articles on wildlife and news items on the conservation movement in Malaysia. The organization is active in public education, the mobile education unit equipped with films and phamplets providing educational programmes especially for schools. "Friends of the Earth, Malaysia", was formed in 1977, to act as a concerned citizens' group campaign against the deterioration of the environment and taking up issues related to the environment, ranging from the problems of the depletion of water and fish resources, in indiscriminal feeling of the forests, the extinction of the wildlife and the destruction of other invaluable natural resources, problems related to soil erosion, the effect of drought, the continuing occurrence of floods, the wide spread misuse of pesticides, pollution from quarrying and mining activities, indiscriminate disposal of sewage and industrial effluents and the dangers of nuclear energy Since its inception, several work programmes have been implemented, information documented on various issues affecting the environment, studies and research have been conducted on environmental problems, statements and memorandums released and it has conducted several public exhibitions, talks and seminars, and initiated a newspaper columns on environmental issues in Malay, English and Chinese national dailies thus generating awareness and interest among the public.

The Utusan Konsumer, a monthly publication of the Consumer Association of Penang, carries a wealth of information on the environment for public consumption. The consumer associations in the country too contribute services towards public education in the form of talks, exhibitions and bulletins.

There are also out-of-school youth activities which play an important role in non-formal education. These include the activities of school, clubs and societies, youth wings of political partities, university student activities to name a few. Their activities are not only limited to exhibitions, field trips and camping programmes but extend to community orientated programmes which would require knowledge and understanding of environmental principles.

Zoos, acquariums, botanical gardens, museum, national parks, to name others, provide useful services for non-formal environmental education. The National Zoo Education Center provides educational services not only for school groups but also public visitors with information that is well presented so that while creating interest, visitors are educated on issues with which ought to be concerned. The Department of Wildlife and National Parks, in co-operation with the Ministry of Education, has set up a 'live-in' study centre in the National Park whose only access is by river. The center conducts nature study programmes for school children during school holidays. The University of Malaya's Field Study Center, within easy reach from Kuala Lumpur, helps with teaching and research for local universities and, in addition, can accommodate visitors from abroad.

Thus individual efforts are being taken by government and voluntary organizations to educate the citizens on environment and conservation issues. But an essential weakness in the effort is the lack of a co-ordinated approach and a channelling of efforts to establish an organized and systematic programme for non-formal environmental education in the country.

References

1. *The Mid-Term Review of Second Malaysia Plan,* Government Press, Kuala Lumpur, 1973, p. v.
2. *The Third Malaysia Plan* (1976-80), Government Press, Kuala Lumpur, 1976, page 218.

3. Ibid., page 226.
4. *Sekitar*, Vol. 1, No. 2, August 1979, Page 13.
5. *The Third Malaysia Plan*, op. cit., para 693, p. 227.
6. For further details refer to Chelliah T., "Training of Teachers with Science or Humanities Background for Environmental Education: A Malaysian Case Study," *Environmental Education and Information*, 1981, Vol. 1, No. 2, 95-107; and T. Chelliah, "A Malaysian Experimental Programme: Environmental education training for teachers with a background in the humanities", *Bulletin of the UNESCO Regional Office for Education in Asia and the Pacific*, No. 22, June, 1981, pp. 271-282.
7. *The Third Malaysia Plan*, op. cit., para 664, p. 219.

Environmental Education in Oman

REDHA SAEED MOHD.*

The interaction between man and environment is as old as the very existence of mankind on earth. Many human achievements, especially in the field of scientific research and technology could be considered as the outcome of this eternal relationship between man and environment. Through this day-to-day interaction with the surrounding environment, man, wherever he is, could gain much experience and knowledge that he should intelligently use for improving his living conditions and fulfilling his ever-increasing demands and needs.

The aims of environmental education in the Sultanate of Oman must be considered in the context of our philosophy and general aims of education which are: to develop, as fully as possible, in all individuals the knowledge, skills and attitudes required for an active, happy and participating life.

Basically environmental education is required to teach students to be aware of the social implications and the inter-dependence of both conservation and development. It should also give decision-makers and, as far as possible, the general public an understanding of the environment and its basic technological interactions so that they may be able intelligently to influence government programmes for the rational development of the earth's resources.

Rather than thinking of environmental education as a new subject for Omani schools, it has been regarded as a multidisciplinary field of study in which several already existing subjects in the curriculum can play a part.

With this in mind, the Ministry of Education ensured that special emphasis was placed on the objectives of the new curricula so that they clearly reflect Oman's concern with conservation of the environment and prevention of pollution.

The natural and social sciences curricula are examples of this trend.

---

*Ministry of Education, Curriculum Dept., Sultanate of Oman.

Emphasis is on the study of the Omani environment and the effect of civilisation, in the form of Man and Technology, on this environment.

The curricula also seek to impart to pupils a knowledge of the natural resources of Oman and the necessity for careful development of these resources so that the balance of nature is maintained. Energy studies form an important part of the science curriculum.

In the field of adult education several post-literacy books dealing with environmental issues have been published in Arabic and distributed by the Ministry of Education. Other projects have dealt with community development through the efforts of pupils and villagers. Much has been accomplished in upgrading the surrounding environment near villages such as the prevention of well and falaj* pollution, road improvement, clean-up campaigns, post control, etc. Our books for literacy classes also include a lot of material on Man's interaction with his environment.

The foregoing is a short account of some of the important steps the Ministry of Education has taken on the road to environmental education.

Sience Centre and Science Clubs for Omani Youth

The Ministry of Education is taking steps to establish a major science centre for Omani youth in the Capital Area. In 1979/1980 the Department of Educational Activities set up six regional science clubs, 5 of which were for boys and 1 for girls. A further three clubs were opened in the academic year of 1980/81, 2 for boys and 1 for girls. All these clubs are at present housed in secondary schools and have a total of 162 pupils as members. Their objectives are closely related to the principles of environmental education and the projects already undertaken, such as:

(i) water and pollution

(ii) the use of wood as fuel

clearly illustrate this point. Exchange visits with other science clubs in the region as well as short training courses for club leaders are among other planned activities.

Training for Primary School Teachers

The Ministry of Education has long expressed interest in training primary school teachers to enable them to undertake simple activities in Environmental Education.

---

*Water Canal.

There has been correspondence on this matter between the IUCN in Switzerland and the Ministry of Education in Muscat, but the matter was deferred till the National Committee for Environmental Education has been established. A copy of the curriculum of the teacher training colleges has been sent already to the IUCN.

The Council for Conservation of the Environment and Prevention of Pollution has published a few simplified books in Arabic and English, about the wild flowers of Oman, Buterflies of Oman, and about the conservation of wild life in Oman. These books are simple enough to educate the children and the general public. The Council has also produced many films for Omani Television.

Hopefuly these books, films and other publications will be the basis that will help students to study the Natural History of Oman. These books will also work to bring to life a better understanding of the conservation of the Environment among Omani citizens. This understanding will be augmented through Environmental Education in our schools, research studies of the Natural History Musuem (expected to open in 1982), and through Qaboos University scheduled to open in a few years. In this way Omani youth would be well qualified to study the natural sciences so that they would be able to carry out future scientific research needed for rational development and conservation of our natural environment.

The new Omani curriculum has made every attempt to include the concepts of "Conservation of Environment and Prevention of Pollution" in text books from the early years of school and throughout the higher levels of the secondary schools. Examples to illustrate what is being taught as environmental Education are given here:

A. Causes of Pollution

(a) Man's struggle towards a better life, and a higher standard of living through higher consumption and resource development, e.g.,

— The various modern means of transportation

— Nuclear and Atomic experimentation, and resultant radiation harmful to mankind

— Development of Technology and Industry especially the Chemical industries

(b) The armament industry

(c) Over crowded cities

(d) Oils especially petrol leakages that pollute seas and rivers

(e) The wastage of energy resources in industry, transportation and domestic usage

(f) Population Explosion and hunger

(g) The extravagance in using natural resources

(h) Poverty and disease

(i) Organic wastes

B. The Concept of Pollution

The importance of this concept has become greater due to the growing number of the world's population, the complexity of modern life which leads to more excesses, and the difficulty of moving to a new environment that is not polluted, as was done before. Man is living now in large crowded cities with people, modern transportation, and factories. Human needs are getting more complex, while waste is accumulating at an alarming rate, so that it is more difficult to absorb and get rid of.

Coming back to examples of Environmental Education in the curriculum we come to these headings.

1. *Water Pollution*

Its causes and explicit examples about a number of oceans which are polluted due to the direct flow of drainage systems into them, and the wastes from industry and ships. Also the over exploitation of mineral resources especially oil, and the effects these products have on marine life. The rapid decrease of the ratio of oxygen in these waters is another important factor.

2. *Air Pollution*

The significance of air pollution has become more important especially after the industrial revolution. This is also due to the construction of many factories and laboratories that depend on burning vast quantities of coal and oil, to cover their energy needs. This has lead to the presence of many toxic gases that affect human health and make man liable to many diseases of the skin and lungs. It also leads to the destruction of plant and animal life.

3. *Sound Pollution*

This deals with the kinds of artificial noise that negatively affects mankind, causing diseases such as blood pressure, lung diseases, and stomach disorders. Doctors say that three out of four nervous illnesses and four out of five cases of headaches are due to excessive noise.

4. *Chemical and Biological Pollution*

This refers to burning chemicals, suffocating substances, substances that affect the blood, toxic substances, tear gases, Psycho-chemicals, and others.

As for Biological Pollution it will include viruses, Bacteria, etc.

5. *Pollution of Soil and Living Creatures*

Man has lost 1225 million acres through decomposition of soil and land. Two-thirds of world forests has lost its production capacity, 150 kinds of animals and birds have became extinct. 1000 species of wild animals are now rare or threatened by extinction. Because of D.D.T. it is now hazardous to eat liver in the United State because cattle graze on polluted grass with this substances and then accumulate it in their livers. Even the Penguin that lives in the South Pole contains this substance through the fish it eats.

As to mankind, it is expected that after 900 years, 1000 people will inhabit one square meter of land. The weight of the population will equal the weight of the whole earth.

The problem of the population explosion lies in the imbalance between food and population on one hand, and pollution on the other. Man has poisoned everything on this planet including himself.

In the curriculum for Secondary Schools which will be implemented in the next two years, the problems of desertification and deforestation will be discussed and reviewed on the spot through films and field visits to various industry locations that cause pollution. From all of this we conclude that the Omani curriculum has the following aims:

1. The student should be conscious of his positive role in the conservation of Environment.
2. The student should know the danger which threatens human life through continuous pollution.

3. The recognition of the integration of the various systems of the environment, and the role of society in keeping the environmental balance and in the diminishing of pollution hazards.
4. The use of what the student learns in science and technology to solve environmental problems, especially pollution aspects.

Finally, I would like to thank again the society for organizing this meeting, and sincerely hope that it will lead to better world wide understanding of the meaning of Environmental Education, and encourage the teaching of conservation concepts so that we may have a better world, and a better environment for generations to come.

Introduction of Nuclear Power in the Philippines: A Case Study

SR. M. AIDA VELASQUEZ, OSB*

The Breadth and Depth of the opposition to the Bataan Nuclear Power Plant and the Philippine Environmental Movement

With the encouragement of the US government backed up by "generous loans" from the Export-Import Bank, the Marcos administration started preparation of the site for the Bataan Nuclear Power Plant (BNPP) in early 1976. The target was for a 620-megawatt Westinghouse pressurized water reactor plant to be operational by 1982. This most expensive single project has become the most questioned undertaking in the Philippines. The history of opposition to it has grown in depth and has involved many sectors of Philippine Society.

The town of Morong is at the tip of the Bataan Peninsula, isolated from the other towns of Bataan and could be reached by a single road from Balanga, the capital of the province, some 60 kms. away. The population of about 11,000 are spread out in the town center and four barrios (villages). Most of the adults barely finished elementary schooling. They are self-sufficient and many are hard-working subsistence farmers and fishermen. The people grow enough rice for their needs plus a little surplus. There are a good variety of fruit trees and vegetables. And the sea has supplied them with plenty of fish and other sea food. There were several milkfish spawning areas and the biggest municipal source of income came from the sale of milkfish fingerlings. These were supplied mostly to the fishponds in Bataan and some in Pampanga.

In general, the people are content with the rhythm of their simple, frugal life.

The citizens of Morong, Bataan suddenly learned that a nuclear power plant would be built in their town. They did not know anything about nuclear power. They knew about the project when some teachers were asked to take a census of the population, including their animals, and when work started on the roads and bridges linking Morong to Balanga. About three or four months later, a large warning sign was painted across the wall of the elementary school building—"Fight the Nuclear Poison!"

---

*Vice Chairman, Phil Federation for Environmental Concern, Manila.

This made the people apprehensive and they started asking what this nuclear power was all about. A group of responsible citizens decided to study about it with the help of a chemist-friend who was staying in another town some 90 kms. away. From some magazine articles and books available, the group realized that together with the promise of "abundant electricity" nuclear power brings hazards to life and environment.

When they learned of the dangers of thermal pollution of their fishing grounds and of radiation that can come from the normal operation of a nuclear plant, in case of accidents and from radioactive waste, their spontaneous reaction was to question the wisdom of putting up the plant. "Why would we want a nuclear power plant that can endanger the people?. . . . We have lived without electricity before, we can do without it rather than risk our life and environment. . . . We should inform others about this," they remarked.

Some more study sessions were held and despite the atmosphere of fear generated by martial law and the reality of repression from municipal officials (like denying permit to hold information drive on nuclear power) and military harassment (like questioning persons who attended a village meeting which was termed "illegal") against those who helped the people understand the hazards of nuclear power, most of the citizens of Morong heard of the risks being imposed on them with the construction of the nuclear plant. Mimeographed materials were distributed in the parish church and were passed on to others quietly. Friends and relatives talked about it in their small circles.

Efforts were made to inform the other towns of Bataan. Many groups coming from various sectors—workers, students, professionals, urban poor, housewives, pastors, priests and religious knew about the nuclear issue through the efforts of the Philippine Movement for Environmental Protection (PMEP). These groups in turn helped disseminate information and joined the opposition of the people of Bataan.

Appeal for help was made, especially in the U.S., and contacts were established. Concerned individuals from other countries, particularly

Mr. S Jacob Scherr of the Natural Resources Defense Council, helped obtain information in the U.S. regarding the Bataan Nuclear Power Plant. He and Mr Nicanor Perlas of the PMEP, generated interest, concern and support from grassroot groups to members of the U.S. Congress. Numerous letter-campaigns were pursued and three International Days of Protest against the export of a Westinghouse nuclear reactor to the Philippines were held in the U.S., Australia, Japan, Canada, W. Germany, Spain, France and Switzerland in 1978 and 1979. Environmental, human rights, labor unions and consumer groups came together to oppose the Bataan nuclear reactor export.

The Three Mile Island accident convinced many others of the risks of building a nuclear plant in Bataan, a volcanic region with a history of strong earthquakes. Tidal waves lashed the area in the early seventies. There are earth faults close to the plant. A report made by a team from the Int'l Atomic Energy Agency stated that a more thorough study of the area should be carried out. This was disclosed when construction of the plant was suspended and a commission of three judges was appointed by Mr Marcos to conduct hearings on the safety of the plant. In Nov. 1979, the Commission declared that the BNPP is a "potential hazard to the health and safety of the public". However, it declared the site safe despite the contrary testimonies presented at the hearing, and without the benefit of further scientific investigation of the site which was recommended by the IAEA and indicated by the study of the Bureau of Mines.

For a while the opponents to the BNPP thought that was the end of the nuclear project. However, in early 1980, the U.S. Nuclear Regulatory Commission ruled that the safety, health, and environmental review required of nuclear plants in the U.S., is not needed in order to grant a license to Westinghouse to export a nuclear reactor to Bataan. Behind closed doors, Westinghouse and the National Power Corporation (Owner of the BNPP) renegotiated the contract, incorporating additional safeguards. In Sept., 1980 Mr Marcos ordered the resumption of construction of the BNPP, the cost of which jumped to almost $2 billion from an initial offer of $500 million for two units by Westinghouse Electric Corp.

In March, 1981, Robert Pollard, nuclear safety engineer, formerly with the U.S. NRC, told a Filipino audience in Manila that less than half of the safeguards required of U.S. nuclear plants after the TMI accident, are being incorporated in the BNPP. He said if the plant would be built in the U.S. it could not be licensed because of insufficient safeguards. He concluded that the BNPP "will not be reliable, will not be inexpensive, and will not be safe."

Up to this time of writing, Westinghouse and the National Power Corporation have not answered these charges.

Meanwhile opposition to the nuclear plant swelled, symposia on the issue multiplied in schools and a good number of magazines with national circulation featured the nuclear controversy.

Why has the BNPP received plenty of concern?

Aside from the question of safety of the reactor and of the site, the following questions have been raised:

1. Does the Philippines need such a sophisticated technology and can it afford its cost? The basic needs of the majority of our people still have to be answered. How can our ill-fed, ill-clothed, and ill-housed people enjoy the blessings of more electricity which is geared to create unnecessary consumption?

2. Why generate more dependence on other countries for fuel, expertise, maintenance, spare parts, reprocessing of fuel and radioactive waste disposal?

3. Who will benefit from more electricity? Not the ordinary people, but the foreign-owned companies and military bases nearby.

4. There is no place for the permanent disposal of radioactive waste in the Philippines according to Dr. Ibe, former head of the Phil Atomic Energy Commission. Why produce radioactive waste when the commercial technology and site for its disposal are unknown? Isn't this gross irresponsibility and a crime against future generations?

For many foreign support groups, esp. in the U.S., this represented a test case for nuclear reactor-export to the Third World. Since the nuclear industry has lost its market in the U.S. and other countries, there is a drive to dump nuclear reactors in developing countries.

Why do many Filipinos reject nuclear power? As in other parts of the world, people realize right away that their very survival is threatened. Who would want to bargain with his life?

In addition, people feel that this kind of bargaining is unnecessary. There are other alternative sources of energy. Solar energy can be made available. In the Philippines, geothermal, hydro, and bio mass energy can adequately support the energy needs of our people. Much of the so-called "energy-crisis" in our country has to do with oil for transportation and not for power generation.

People will keep opposing nuclear power because now they know that very much information has kept hidden and obscured from them. Much nuclear misinformation and suppression have come to light. The boast of the nuclear proponents of the "unparalleled safety record of the nuclear industry" was made empty by the TMI accident. Dr. Rosalie Bertell and Mr Natarajan showed that radiation from the normal operation of the nuclear plants is harmful to man.[1] This is confirmed by an independent factual study on human exposures to low level radiation conducted by Dr Mancuso, Stewart and Kneale.

Experience of farmers living near nuclear facilities with their farm animals strengthens this observation. Miscarriage, still births, malformation of bones, among others have been observed among farm animals near nuclear facilities.[2, 3]

Man is now given a glimpse of the horrors awaiting future generations through the heart-breaking experience of the people of the Marshall Islands in the Pacific who received massive doses of radiation particularly when the U.S. tested the biggest H-bomb in 1954. Later, women suffered miscarriage, stillbirths and birth of monstrosites.[4] They gave birth to something that did not look human. A baby was born with no eyes; another, without legs; another; without arms. A baby was born without skin; another, without any bones in its body; another, without a skull. Women described giving birth to something like the eggs or intestines of a sea turtle, something resembling a crab, an octopus, a cat, a rat, a monkey. Others resembled grapes, or the bark of a coconut tree, or just a watery mass or a placenta.[5]

This points to what can happen with exposure of people to radiation over a long period of time. And lest we forget, there is the experience of the people of Hiroshima and Nagasaki.

One cannot but confront the link between nuclear power and nuclear weapons. Plutonium from the spent fuel of a nuclear plant can be used for the production of weapons. A country with nuclear technology has also the technology to manufacture bombs.

The question of nuclear weapons brings up the question of foreign military bases in a country. Many Filipinos are worried that the Philippines will be dragged again into a war not of our own making because of the two big U.S. military bases in the country. One of these, the Subic Naval Base, is less than 10 mi from the BNPP projected to be operational by late 1984. We see the possibility of a nuclear attack on these bases in case of a confrontation between the U.S. and the USSR.

How can these risks be a fair exchange for the electricity expected from the BNPP which represents "4.55% of the probable source-mix" according to the Ministry of Energy.

Role of Environmental Movement

The BNPP-issue has opened the eyes of the Filipinos to the plight of people from other countries who have suffered from the promotion of nuclear power and production of nuclear weapons. It has helped the Filipino identify himself with the American-Indians and Australian aborigines with their problems coming from the mining and milling of uranium; with the people of TMI and of Tsuruga and other places already affected by the operation of nuclear facilities; with the people of the Pacific who are victims of weapons testing which is still continuing and who are further threatened by the Japanese plan to dump nuclear waste in the Pacific. The Filipino can identify with the Europeans, Americans and other peoples in their clamour for disarmament and cry for peace.

The strong desire of the environmentalist to nurture life and to preserve a healthy environment that will sustain that life is bringing people together and inviting them to go beyond what formerly appeared as insurmountable differences, to build little by little, consciously or unconsciously, the global community. In the process, respect for man's dignity and the desire for better management and more just distribution of resources is taking root in the consciousness of more people and inspiring and encouraging them to work in their local areas. Gripped by a common overwhelming problem—the survival of planet earth, men are reaching out to one another more earnestly in friendship and brotherhood.

The environmental movement, sustained by enough exchange of information and sufficient communication and cooperation among groups, cannot but grow because deep down, every man is an environmentalist.

References

1. Bertell, Rosalie, "The Nuclear Crossroads," Apr 29, 1978.
2. Leppzer, Robert, Voices from Three Mile Island, The Crossing Press, 1980.
3. Del Tredici, Robert, The People of Three Mile Island, Sierra Club Books, 1980.
4. Merliss, Reuben, Letter to Mr Gordon Stemple, July, 1980.
5. Alcalay, Glenn, "Report on Field Research Visit to the Marshall Islands", Mar, 1981.
6. Schirmer, Boone, "Involuntary Suicide, US Nuclear Installations in the Phil", Aug, 1981.

Report on Environmental Situation in Sri Lanka

EARDLEY W. SENEVIRATNE*

Introduction

"Man is both creature and moulder of his environment, which gives him physical sustenance and affords him the opportunity for intellectual, moral, social and spiritual development. In the long and tortuous evolution of the human race on this planet, a stage has been reached when through the rapid acceleration of science and technology, man has acquired the power to transform his environment in countless ways on an unprecedented scale. Both aspects of man's environment, the natural and man-made, are essential to his well-being and to the enjoyment of basic human rights, even the right to life itself."

The word 'environment' means nothing more than the totality of the circumstances in which we live and work. No man it is said is an island unto himself; no creature is independent of his environment. The protection and improvement of the human environment has now become a matter of deep concern for all men and all nations.

The recognition of the fact that man has but this one planet on which to live, that the biosphere which surrounds it is fragile and easily damaged and that he must learn to work with his environment, not against it, have begun to stir people and nations to the need for collaboration in seeking measures to protect the earth and its environment from man himself.

In his quest for better living, man has increasingly exploited the natural resources. Although the earth's natural resources are vast, they are not limitless. Due to over exploitation on the part of man at least some of these resources are no more and some others are fast disappear ing, one such being the whale. Examples of similar over exploitation which has led or would lead to the extinction of some animals and plants are innumerable. Further, this is not limited solely to biological resources

---

*Deputy Conservator of Forests, Management, Research & Education, Forest Department, Sri Lanka.

but applicable to every natural resource. Only proper environmental management and timely action can prevent a catastrophe.

Scientists have for a long time realized that all life is interdependent. Any change that seriously interferes with any living or biogeochemical cycle can have a major impact on life as a whole.

Soaring and alarming population figures have become a common feature in most countries. As alarming has been the great increase of pollution in urban areas. Massive increases and concentrations of population are taxing many nations' ability to cope with the problems they give rise to; they seem to grow more rapidly than government's ability to limit or contain them and they seriously endanger the quality of the environment and deplete if not exhaust our natural resources.

In Sri Lanka environmental degradation and pollution are widespread. In recent years there has been an upsurge of public concern over the denudation of the Island's forest cover; the indiscriminate blasting of the coral reef; increasing pollution of rivers, canals, lakes, coastal waters, vegetation and atmosphere and by uncontrolled urbanization.

Alarmed by the gravity of this situation the Sri Lanka Environment Society and other environmental groups in the country set up a Citizen's Task Force to examine the environmental situation and report on the formulation and implementation of a national environmental policy. The report of the Task Force was published in 1978 and concrete recommendations were made on the protection and management of the environment.

Management of Natural Resources

The management of our natural resources is one part of environmental management, and at a time when Sri Lanka is at a juncture where her natural resources will have to be scientifically exploited to its fullest extent a planned programme is warranted on a long-term basis. The following natural resources: (a) soil, (b) water, (c) energy, (d) forests, (e) fauna and flora, (f) living aquatic resources, and (g) minerals therefore must be managed for the benefit of future generations.

Soil

It is one of the most important natural resources of Sri Lanka as our economy is still largely agricultural. The characteristics of the soil are therefore important in locating agricultural projects, formulating cropping patterns for different areas, selecting lands for irrigation, predicting irrigation and fertilizer requirements and practices, recommending farm layout plans and general land use planning.

The proper utilization of forestry resources is also dependent on a good knowledge of soil conditions, and it must be remembered that the growth potential of different species in natural forests is highly dependent on soil conditions.

The subject of erosion and soil conservation has not received the recognition and importance it should have despite the references and pronouncements of that eminent scientist and naturalist Sir Joseph Hooker in 1873. However, his memorable land order prohibiting the clearing of forests over 5,000 ft. and his advice on conserving forests resulted in the Forest Ordinance of 1885 which is a landmark in environmental conservation in Sri Lanka. Nevertheless, erosion and soil conservation have received low priority in the Island's development programmes in the past. There is yet a tendency to overlook the adverse effects of erosion as it continues and escalates under programmes of land clearing, settlement and agricultural development. The irreparable damage caused by ad hoc large scale forest and land clearance for potato farming above an elevation of 5,000 ft. necessitated State intervention and a ban was imposed in certain critical areas.

Water

Rain precipitation on the land surface of Sri Lanka, in extent 25,332 sq. miles or 16.25 million acres, is our only source of water. The long-term average rainfall varies from nearly 40 inches in the dry zone to 225 inches in the wet zone. The rainfall pattern divides the country into three zones, viz., the wet, intermediate and the dry zones. In terms of water, the precipitation amounts to 103 million acre feet or 6.25 ft. depth of water over the whole island.

The total quantity of water drained into the sea as surface run-off from the land mass is estimated to be 39.7 million acre feet or 38 per cent of the total volume of the precipitation.

The estimated long-term average yield from 83 rivers of the dry zone is 18.2 million acre ft. per annum and that of the 20 rivers of the wet zone is estimated to be 21.5 million acre feet. Floods and waterlogging are common features in the wet zone.

The expanding population of our country which today is 14.9 million, makes more and more demands on water which is a vital resource indispensable for sustaining all forms of life and hence it is of paramount importance that proper and adequate conservation measures be adopted to prevent depletion and waste.

Energy

Sri Lanka's major power resource at present and in the years to come will be the hydro-potential of her rivers.

Hydro-power development on a commercial basis started only after the completion of the Laxapana Power Plant in 1950, though some small hydro-power stations existed before that time. Since 1950, five hydro-power plants have been constructed at Inginiyagala, Norton, Uda Walawe, Polpitiya and Castle Reagh with a 50 MW thermal station—Kelanitissa in Colombo—which serves as a back-up for hydro-power during the dry season.

Forests

The factual position with regard to forest extent was determined as far back as 1956 when an air survey and an inventory were carried out. Since that time wide ranging changes in land use have taken place and at present only estimates of forest extents are available for planning and administrative purposes. An all-island inventory of forest resources will be undertaken this year with foreign assistance.

It is worth recounting the fate of forests because certain patterns emerge with regard to the escalating struggle between man and his environment. According to records, there was an extent of 7.2 million acres of forests in 1902 when the population density was 141 persons per sq. mile or the equivalent of 2.0 acres forest/capita. Due to a rise in population density to 340 persons per sq. mile in 1956, the forest extent which had remained more or less unaltered had dropped to 0.8 acre/capita. A further rise in population density to 560 persons per sq. mile at the present time has been at the expense of forests which declined in absolute extent to 4 0 million acres or 0.3 acre/capita which is the lowest for Asia and the Far East after Bangladesh and Pakistan.

The estimated 4.0 million acres represents 25 percent of the total land area. In effect, forests have declined from the 1956 position at the rate of 1 percent of the total land per annum or roughly 160,000 acres every year. Within the next few years another 600,000 acres of mainly low timber yield forest are expected to be cleared under the Mahaweli Scheme resulting in a balance extent which works out to about 20 percent. If this 20 percent can be preserved, then at the present rate of population increase which is expected to rise to a population density of 1000/sq. mile by the turn of this century, there would then be a meagre 0.1 acre forest/capita.

Today, the extent of forest in the populated wet zone has dwindled to the alarming low figure of 9 percent of the land area of this region. In the upper catchment area of the Mahaweli river only 8 percent of the catchment is under forest cover and viewed against the amounts of silt carried down the rivers, the situation may prove quite serious for soil and water conservation unless intensively managed at the micro-catchment level.

Land Use in Sri Lanka

The land surface area covering an extent of 16 million acres consists broadly of forest land, agricultural land systematically cultivated with crops, cultivated and abandoned 'chena' land (shifting cultivation), grass land, savannah, scrub, swamp, marsh land and homestead gardens. The tea, rubber and coconut lands together make up nearly 11 percent of the total land area. In the dry zone of the island there is a large potential area available for development under crops. In a developing country like Sri Lanka we face a real problem in that on the one hand, we have to develop quickly, while on the other we have to simultaneously protect our environment lest we end up in a situation like that facing some highly developed countries.

Land Use Planning and Allocation

As far back as 1958, the Land Commission of Sri Lanka recommended the setting up of an organisation for the physical planning of land use on an island-wide basis. Since no special attention had been pursued on the question of rational and systematic land use planning, the need for the establishment of a National Land Use Authority was emphasized again last year. The 'mapping out' of State land had been carried out on an ad hoc village basis, and was not undertaken for the entirety of the State lands nor done on any scientific basis. This exercise too was completely abandoned during the last two decades and owing to the non-availability of final land use plans encroachments on State land have taken place unabated. Further, land reform had brought within the purview of State control and management nearly one million acres of both well managed as well as badly neglected lands—the latter requiring urgent remedial measures to halt further soil erosion, environmental degradation and declining employment opportunities.

There have also been instances of conflicting overlap of land use plans prepared by separate institutions and generally in isolation of each other, but covering part of the same geographical area. A classic example is the ever-present conflict in the wet zone areas between village expansion needs and plantation development or forest conservation.

It is estimated that around one million acres of State lands are encroached upon and their utilisation has not been monitored. In addition, a further 70,000 acres approximately of reservations, hazard-prone lands and sensitive steep slopes in the mountainous regions are also reported to have been encroached.

The Mahaweli Diversion Scheme which has ushered in a great revolution in agricultural development and land use in the various sectors of the dry zone will encompass nearly 600,000 acres of forest land.

There are other river valley development projects planned and partly implemented in the south, east, west and northwest of the country, chief of which are the Menik Ganga Project, Kirindi Oya Basin Development, Uda Walawe Scheme (completed), Kelani Diversion Scheme, etc., which will account for approximately 250,000 acres of new land to be cleared of forests. Thus a total of 900,000 acres or 5.5 percent of the total land area will come under agricultural development, whereas all the tea, rubber and coconut lands together make up 11 percent.

The Impact of Different Types of Land Use

The biotic ill-effects as a result of human mismanagement in Sri Lanka can well be understood when one realizes that over a century ago, the central highlands were clothed with dense evergreen forests which made possible the uninterrupted successful cultivation of arable lands in parts of the lowland dry zone fed from the central hills. With this prudent system of forest-soil-water management, agriculture in Sri Lanka thrived and this country was dubbed the 'granary of the east'. However, the situation changed when these forests were indiscriminately cleared, unleashing problems of severe erosion on steep lands, flooding and sedimentation in the lowlands and the final engress of precious top soil into the sea via the numerous rivers in the country. This was followed by a steady decline of irrigated agriculture and heavy dependency on food imports. However, with the judicious implementation of river valley development schemes, we are on the threshold of reversing the harmful tide and being self-sufficient in the estaple food, rice.

The different types of land use, the various development projects being implemented and envisaged and the high incidence of encroachment on State lands no doubt result in environmental degradation and considerable damage to the eco-system. In the wet zone the eco-systems therein are delicate and fragile so that protective forests are most needed in such regions but the forest reserves have dwindled to the alarmingly low figure of 9 percent of the land area. This is essentially due to errors in planning and misuse of land resulting in large scale deterioration of the environment, which may even cause irreversible destruction.

The resultant problems of loss of land productivity, water pollution, flood risks and loss of storage capacity in reservoirs can well be imagined when the silt load data collected by the Hydrology Division of the Irrigation Department at a point at the lower end of the Upper Mahaweli catchment showed that over the period 1964 to 1970 an average of 300,000 tons of silt had been eroded away from this catchment every year. This is essentially due to the reduction of the forest cover to about 8 percent of the total area of the Upper Catchment of the Mahaweli river, during the last 20 years.

The environmental impact of the loss of trees and forest cover is well illustrated by the devastation in the cyclone affected areas in the Eastern Coast—cyclone of November 1978. An ecological disaster has overtaken these areas as a result of the more or less complete removal of overhead vegetation cover. Quantification of these effects are still not known, but the intense glare, warmer days and cooler nights reminiscent of desert-like conditions, wind effects etc. can be clearly perceived.

Then again, the natural protection that our coastal reefs have provided for centuries is rapidly diminishing. In the south of Sri Lanka at Hikkaduwa, a popular tourist resort, a long belt of coastline about 1000 ft. wide and valued at nearly 27 million rupees has been washed away within the last 60 years, as a result of coral extraction and the breaching of the reefs. Hikkaduwa is one of the best coastal resort areas and boasts of one of the finest coral formations in the island but today the major environmental problems are faecal and oil pollution of beaches, waste water outlets and the conservation of coral and fish.

Floods and Flood Frequency

Although floods may occur at any time of the year in Sri Lanka the majority of high flows are associated with the rains of the monsoon periods, namely the South West Monsoon (May to July) and the North East Monsoon (October to January). However, examination of the hydrographs of flow indicates that many of the extreme flows recorded have occurred at other times of the year.

To illustrate the frequency of floods, hydrographs of two major rivers—the Maheweli and Kelani—have been studied and it was observed that flood flows have occurred in all months of the year. It has also been shown that besides the monsoonal periods, Sri Lanka is subject to severe depressional and cyclonic storms during other times of the year as well. A total of 99 major cyclones have been observed to pass over Sri Lanka or near enough to influence the weather conditions, significantly, during the period 1845 to 1958. The high incidence of cyclones is associated with the inter-monsoon period of the South West Monsoon and the North East Monsoon period. These storms are essentially due to depressions in the Bay of Bengal and the Arabian Sea.

Although floods are experienced frequently on nearly all rivers throughout Sri Lanka, few of them cause extensive economic loss. Yet, they are of damaging proportions and the frequency has increased considerably over the years and especially during the last 20 years mainly because of the decrease in the forest cover, extensive land clearings, encroachments on reservations and sensitive steep slopes and the lack of proper land use planning, management, control and allocation of State land.

In Sri Lanka, the dry weather flow in rivers like the Mahaweli or Walawe are much more useful than the maximum flow through these rivers. Even in wet zone rivers, particularly those which are used for hydro-electricity, sustained flow is important. In recent times there has been a complete change in the weather patterns resulting in more frequent drought over prolonged periods and there have been occasions in Colombo when thermal power has had to be used because of insufficiency of water in the reservoirs to generate hydro-power.

Ill-considered land use practices and the indiscriminate felling of trees to meet the country's requirements of fuel and timber combined with large scale encroachments and shifting cultivation in State land have been responsible for the large scale destruction of one of the island's chief resources. The denudation of forest cover is the chief cause of soil erosion, depletion of the dry weather water supplies to hydro, irrigation and other functions, frequent and disastrous flooding and the general deterioration of local climates. All these factors have profound short-term and long-term effects on agriculture and other development projects and therefore on employment opportunities. To arrest the immediate largescale deterioration of the environment as a result of mismanagement, heavy demands on timber and forest products and haphazard land use, the government has taken various courses of action, the chief of which are:

(a) Total ban on the excisions of forests in the wet zone except for small extents for public purposes.

(b) Areas coming under development in the dry zone only will be available for exploitation of timber. However, specific forests in the wet zone will be made available for scientific exploitation under strict supervision to maintain minimal supplies of timber to industry and the public.

(c) Harvesting of timber will be purely on a selection basis and conforming strictly to the felling rules prepared by the Forestry Department.

(d) Free import of timber.

(e) Total ban on clearing of forests and alienation of land over 5000 ft. elevation.

(f) Integration of forestry with agriculture, plantation sectors and in settlement planning.

(g) Total ban on the issue of chena permits—shifting cultivation.

(h) Re-settling of encroachers on forest reserves, road, river and stream reservations and reforesting such areas.

(i) Amending the Forest Ordinance and the regulations framed thereunder providing for deterrent punishment including mandatory term of imprisonment for some offences and automatic confiscation of tools, boats, carts, vehicles etc. used in the commission of Forest Offences on conviction by a Court of Law.

(j) Preservation of representative forest communities typical of each climatic zone has been undertaken in various parts of the country under the International Man and Biosphere programme, the idea being to preserve gene resources for study and spread at a future data in the light of dwindling natural forests.

Environmental Pollution and Contamination

Environmental pollution, a by-product of the development and maintenance of modern civilization, now poses a serious threat to human existence on this planet. The overall pollution problem consists in preserving the biosphere—the life giving, relatively thin layer of soil, atmosphere and water in which replenishing cycles of living organisms take place.

Attempts were made a few years ago to evaluate the degree of pollution in Sri Lanka but hardly any data was available on the high inputs of fertilisers and pesticides in agriculture lands, problems of sewage and waste disposal caused by population increase and urbanisation and the amount of wastes dumped on to the land, water and the sea or emitted into the atmosphere.

Industrial Pollution

In developing countries where industrialisation is almost in its infancy, this problem fortunately is not so acute in this country. In Sri Lanka, the discharge of effluents of the batik and other textile industries is a common sight as these effluents freely flow into drains, streams and rivers. In Colombo itself, a probe of the Wellawatte Canal revealed that it is being polluted by the dumping of untreated sewage, industrial waste by industrial concerns and faecal pollution by persons residing along the banks of the canal.

The major industries that cause pollution of the atmosphere and water in Sri Lanka are paper, agro-chemicals, cement, petroleum, leather, ceramics, textiles, rubber, rice and saw mills, construction industry, asbestos and chemical factories.

Sri Lanka has been mainly an agricultural country dependent on an agricultural economy but today intensive industrialisation is under way, particularly in the Industrial Promotion Zone covering an extent of 200 sq. miles close to Colombo. The Greater Colombo Economic Commission is empowered to foster and generate economic development, encourage and promote foreign investment, encourage and foster the establishment and development of industrial and commercial enterprises, etc., within the Republic of Sri Lanka. In order to achieve these objectives the main development of the Industrial Promotion Zone will consist of industrial zones within which factories assembling imported and locally produced components for export will be established with the participation of foreign investors. One of the consequences of such development will be the steep rise in the population of the area which will increase problems of environmental protection.

Pollution through Agricultural Activity

Environmental hazards through agriculture in Sri Lanka arise from the following sources:

(a) Soil erosion, whereby sediments laden with absorbed pesticides and herbicides and even fertilisers are carried into water courses, etc. and thus cause adverse effects.

(b) Animal manures and waste, which when in excess of farm needs will cause pollution when leached into or carried into water courses and even ground water.

(c) Dry Zone irrigation where no drainage facilities are provided, resulting in the development of alkali salts in the soil and causing crop failure.

Soil eroded from cultivated land is the chief source of sediment in rivers, streams and reservoirs but road construction, stream bank and gully erosion, housing development and logging operations are also contributory sources. These sediments contain and absorb compounds which supply plant nutrients such as nitrogen and phosphorus. These promote excessive growth of bacteria, algae and other plant life in the water. Therefore a depletion of dissolved oxygen occurs, especially on death and decay of these organisms, and this results in harmful effects on fish and the onset of conditions conducive to foul odours and undesirable tastes in the water.

In Sri Lanka, fertilisers in agriculture and pesticides and agrochemicals such as DDT, have been used increasingly since the end of World War II. Fertilisers like phosphates and nitrates in excess are a great danger to aquatic life in rivers and lakes and can make conditions difficult for other forms of life except algae. Excess nitrate in potable water may indirectly affect human health and that of infants in particular. Phosphorus is the key element in water pollution and the possibility of phosphate fertilisers being leached out into waterways must be borne in mind.

Insecticides, fungicides and herbicides are used largely for controlling plant pests, plant diseases and weeds. They have no doubt increased the production of man's food and other requirements and even controlled human diseases, e.g., DDT in the control of malaria, at low cost and with great efficacy. Today the high cost of these agrochemicals and the immunity to DDT developed by the Anopheles mosquito have resulted in limited use of the agro-chemicals and the resurgence of malaria.

Draft legislation has been formulated regarding the sale and use of agro-chemicals so as to ensure that these products are not hazards to public life. What is urgently required now is the establishment of efficient laboratory services to systematically analyse plant material, soil and water samples from water courses in the vicinity for toxic residues.

Alkali in the soil can become a serious problem of irrigated farming in the dry zone which is caused or intensified by the lack of soil drainage. The problem is not that serious in Sri Lanka as the rainfall even in the dry zone is sufficient to leach out these salts. There are, however, cases of crop failure reported owing to high alkali content of soil, indicating that the drainage of irrigated land is essential.

Beach Pollution

Sri Lanka is blessed with a 1000-mile shoreline with green vegetation mainly of coconut palms, mangrove forests and low jungle. The beaches and coastal waters are not merely sources of recreation but they are also the means of livelihood of the coastal inhabitants particularly beach-seine fishing, from which 25 to 35 percent of the country's catch of fish is obtained.

Faecal, oil, waste water and industrial pollution are the chief causes of beach pollution and serious attention will have to be given on a national basis to solve these problems.

Problems of Human Settlement

These can be considered broadly under two categories namely (a) health problems, (b) problems other than health.

Health problems: In the development programme being implemented and envisaged, new settlements are provided by the expansion and construction of major irrigation schemes. In the recent past there have been large schemes like Gal Oya, Rajangana and Udawalawe and today we have the accelerated Mahaweli Diversion Scheme where new settlements will be provided under this major scheme. There has also been a continuing urbanisation process, which is further supported by an increase in the density of the population in nearly all the principal towns. This is largely due to the progressive industrialisation and with the establishment of State Corporation Industries in the rural areas, new settlements have been created all over the country to meet this situation. The impact of these new settlements has aggravated the existing health problems.

Land pollution: With the social and economic advancement of the people the wastes produced keep on increasing and with it, methods for its safe and hygienic disposal have to be developed and enforced. The responsibility for the collection and disposal of refuse of domestic, commercial and trade origin rests with the local government administration. The commonest method adopted in this country for the disposal of refuse is mainly by sanitary land fill, while incineration and composting are practised on a smaller scale in certain areas.

Water pollution: There is a rapidly increasing demand for urban water supplies for both domestic and industrial use with increasing urbanisation and industrial growth. The provision of pipe borne water supply is limited to towns which have about 20 per cent of the island's population. The rest of the population obtain water from shallow wells, rivers, streams, tanks and irrigation channels.

Pesticides in public health: Malaria has been endemic in Sri Lanka for many years and epidemics have been reported in the past. Spraying with DDT in both the endemic and epidemic zones on a long-term eradication programme resulted in complete control of malaria. However, today malaria is re-emerging as an environmental and socio-economic problem and we are now faced with a resurgence of this disease. The Anopheles mosquito has developed resistance to DDT and Dieldrin and even to organo phosphorus insecticides such as malathion in many countries but fortunately in Sri Lanka this disease can be brought under control with malathion spraying. In the control of Filariasis, malathion is used as a larvicide and is confined to the coastal belt in the south-western part of the island. There is no evidence of risk to man by the use of DDT or malathion, as there has not been a single death due to poisoning by these insecticides even among the spraymen.

Slum dwelling: These dwellings are found in all parts of the country but are seen most in Colombo, the principal towns and the suburbs. The occupants do not have permanent habitations but occupy whatever State land is available, particularly along roads, canals, and railway reservations, and build their dwellings which are usually huts with thatched roof and without basic amenities like laterines or wells. The dwellers live under sub-human conditions dump their domestic refuse, garbage and night soil on adjoining land or even in canals or streams and invariably pollute the land and waterways. These dwellings are a health hazard and over-crowding has led to increased spread of airborne diseases such as pulmonary tuberculosis. The government has started on a slum clearance scheme and the dwellers are now being resettled and rehabilitated in suitable areas.

Problems other than health: The problem of environmental management and prevention of pollution is worse in urban areas than in the rural areas. This is mainly due to unplanned city development in the past. The trends of development have been to concentrate all development activities mainly in the cities and particularly in Colombo. As a result, a large rural population has continued to migrate to the cities in search of employment and this in turn has resulted in the unauthorised occupation of State land and the construction of slum dwellings and semi-permanent houses which do not have sanitary conveniences.

Today, the picture is changing rapidly as more and more development projects are undertaken away from the cities and suitable housing and other civic amenities are being provided. Another progressive step is the village re-awakening scheme whereby model towns are being established by the government throughout the length and breadth of this country with the ultimate object of constructing 100,000 model houses in the villages with all civic amenities. In these model villages the prevention of pollution and the improvement of the environment have been given due consideration.

Landscape Preservation

The landscape of a country is as much a valuable asset as are its other resources. The country's aesthetic quality, climatic factors and social and economic characteristics constitute a priceless asset. Apart from the visual aspects of landscape, the economic and sociological requirements need to be considered for its preservation and conservation. The main components of the landscape are land, water and vegetation.

Soil fertility is essential for the preservation of a good landscape, and this could be ensured only by proper land use through scientific agricultural practices. In any rural environment the agricultural land pattern and forest or wild vegetation are important features in producing a good landscape. In Sri Lanka the common practice of buring of grassland, together with illicit felling of trees, illicit clearing for chena cultivation (shifting cultivation) and over-exploitation of forests is an outrage against nature, creating an imbalance in the eco-system of the natural environment and resulting in soil erosion and the destruction of the soil-binding vegetation together with either the emigration of fauna to more hospitable regions or their total extinction.

Swollen streams and rivers loaded with silt and precious top soil are common scenes in the planting district of the hill country during the rainy seasons. This is obviously due to soil erosion and more effective measures are required to prevent soil wash in the tea estates.

It is important that Sri Lanka does not join the more advanced and industrialised countries where new landscapes are being artificially created at great costs in the absence of natural vegetation that had been destroyed in the name of progress.

Legislative Enactments Pertaining to Environmental Management

Legislation to prevent pollution of rivers, streams and the atmosphere consist of provisions in the following:

(a) Crown Lands Ordinance and Act (1947-1949)
(b) The Thoroughfares Ordinance and Act (1861-1953)
(c) The Colombo Municipal Bye-laws
(d) The River Valleys Development Board Act (1949-1965)
(e) The Water Resources Board Act (1964)
(f) The Nuisance Ordinance (1862-1946)
(g) Colombo Municipal Council Waterworks Ordinance

Legislation to conserve natural resources in Sri Lanka consists of provisions in the following:

(a) Mines and Minerals Law (1973)
(b) Water Resources Board Act
(c) Soil Conservation Act
(d) Fauna and Flora Protection Ordinance
(e) Water Hyacinth Ordinance
(f) Plant Protection Ordinance
(g) Forest Ordinance

(h) Felling of Trees (Control) Act

(i) Fisheries Ordinance

(j) Chank Fisheries Act

(k) Pearl Fisheries Ordinance

Other legislation pertaining to the environment are embodied in the following:

(a) The Criminal Procedure Code

(b) Penal Code

(c) Food and Drugs Ordinance

(d) Local Authorities Act

(e) Housing and Town Improvement Ordinance

(f) The Town and Country Planning Ordinance

(g) Wells and Pits Ordinance

(h) Tourist Development Act

(i) Ordinances of Municipal, Urban, Town and Village Councils

(j) Local Authorities (Standard bye-laws) Act

It will be seen that considerable amount of legislation pertaining to the environment is already in the statute books. Different aspects of environmental management are governed by separate legal enactments and administered by different government agencies. In many cases, the provisions dealing with environmental management are usually incidental to the main enactment and have not dealt with the problems of conservation and pollution in a comprehensive way, resulting in some of these laws not being effectively enforced.

Until recently there was no organisation in this country to further the protection of the environment through legal action. Environmental Foundation Limited (EFL) came into existence to fill this void. EFL is a public interest law firm—a new concept in Sri Lanka, although one well established in other parts of the world,—and is modelled on the lines of Friends of the Earth Ltd., of Great Britain, National Resources Defence Council (Inc.) and the National Wild Life Federation of the the United States.

One of EFL's main objectives is to undertake environmental cases in courts, to provide legal advice and assistance where necessary, especially to State Lawyers in the prosecution of environmental cases, to monitor State regulatory agencies, to foster public awareness, to enforce and agitate for reform of conservation laws, to conduct and initiate research and study, to undertake and finance projects to repair environmental damage where possible and to promote the beneficial and planned use of natural resources.

Voluntary Organisations Engaged in Environmental Education and Awareness

Sri Lanka is fortunate in that she has a large number of voluntary organisations engaged in varying areas of activity. Significant among these are those organisations which deal with various aspects of the environment.

Public awareness is the most important criterion in implementing any project on the environment. Voluntary organisations are in the best position to bring about the kind of public awareness, motivation and commitment that are necessary for successful action in a multi-disciplinary, all pervasive area of activity like that of the environment. These organisations could also be active in the formal sector of education viz., primary, secondary and tutorial education as well as in the non-formal sector which mainly consists of adult education.

The use of mass media like the press, radio, cinema and television could assist these organisations in the implementation of the objectives of environmental management.

Environmental education in Sri Lanka is geared to creating an awareness among the people on environmental problems, participation of the people in decision-making concerning the environment and in improving the quality of life.

Action has also been initiated to introduce Environmental education in schools curricula and offer courses on Environmental Science at some of the universities in Sri Lanka.

Conclusion

A seminar on the protection and management of the environment was held in Sri Lanka in 1978 which was organised by the Ministry of Local Government, Housing and Construction in association with the United Nations Environment Programme and the Sri Lanka Foundation Institute.

The Seminar recommended an independent Environmental Authority to function directly under His Excellency the President or the Hon. Prime Minister in view of the great national importance of the environmental problems and issues involved and the need for very urgent action.

The principal functions of the Authority recommended were:

(a) Formulation of policies and necessary legislation

(b) Preparation of standards and norms and guidelines for environmental management

(c) Survey of natural resources

(d) Monitoring of environmental conditions

(e) Evaluation of development plans

(f) Enforcement of environmental management

(g) Initiating, sponsoring and suppprting research in environmental matters

(h) Dissemination of environment information

It was also agreed that the survey should cover the following disciplines:

(i) Climate

(ii) Physical resources—soil, water, minerals

(iii) Biological resources—faunas, flora, forests, fisheries, etc.

(iv) Energy

(v) Human resources

(vi) Cultural resources, and

(vii) Aesthetic and recreational resources

The main objective of this Authority is to secure, through the proper management of the environment and the rational use of its resources the optimum benefits to society and the country as a whole and the restoration and preservation of the national heritage of Sri Lankans for the use of all generations present and future.

Environmental Education and Rural Development in Thailand

DR. KASEM CHUNKAO*

Introduction

The population of Thailand at the present time has been estimated 48 million with the growth rate 1.9 per cent. There are about 84 per cent of citizen that are found as farmers and living in the rural area in all parts of the country. Normally, these farmers are poor except very few number in the irrigation area that are wealthy. However, the poverty has caused by high growth rate in the family for the last 10 years tending the decreasing size of farmland to cultivate crops. Evitably, forest have been clearly cut to convert into shifting cultivation. Recently, it was informed that there are approximately 10-12 million people which could not even help themselves. This is why the government has set 10-year plan (1981-1991) for support to improve the quality of life of those poor people in the rural areas.

According to high growth of population with poverty, the natural resources in the rural areas have been extremely utilized with no measure in conservation concept. Undoubtedly, natural resources of the kingdom of Thailand have gradually depleted, particularly in the last two decades upto the present time. The government has tried to put an effort to prevent the damages by laws and its enforcement, but it is unlikely to achieve goal. Education to the people in the rural areas seems to be profitable in terms of changing the conceptual ideas to realize the feedback of pollution to themselves. In fact, education of the people how to know the pollution their resources utilization did not get success among very poor and hunger people. However, the environmental education program is still under way in both formality and informality in the rural of Thailand.

Physical Environment

Thailand is located centrally in the Indochinese Peninsular between

---

*Graduate Committee in Environmental Science (Department of Conservation, Faculty of Forestry), Graduate School, Kasetsart University.

5° 40° to 20° 30° north latitude and 97° 70° to 105° 45½° east longtitude. The total area is approximately 520,000 square kilometers. The longest north-south span is about 1920 kilometers, and the widest part is about 750 kilometers from east to west.

Like other southeast Asian countries, the climate of Thailand has been dominated by monsoon. Wet season begins from May to October, cool and dry season from November to February, and then hot summer from March to May. Annual temperature ranges are small thoughout the country with some what wide ranges in the north at high elevation. The hottest month is April and coldest month is January.

Landform in the central is classified as flat of flood plain area, and two-third-area in the north-east is found as high plateau, while the north, the south and the west mostly are occupied by mountainous land but hilly terrain in the eastern part. Highest productive area for agriculture is also located in the central, second in the south and third in the north, east and west would be the fourth. In so far, the northeastern part is found as the poorest area in the country.

Thailand began to make the population survey in 1910 which found about 8.1 million people in the whole country (Chunkao, 1981 a). Then after that time, about a year, the population increased to be 9.2 million in 1919. Consequently, the population was investigated 11.5 million in 1929, 14.5 million in 1937, 17.4 million in 1947, 26.3 million in 1960, 36.4 million in 1970, 47.3 million in 1980, and 48 million in 1981. Also, the population density of the whole country is approximated 92 persons per square kilometer. This number is identified as medium density for the cultivated land likewise Thailand.

Current Environmental Problems

At the present time, Thailand is facing three main problems (Chunkao, 1981 a): firstly, natural resources has been extremely utilized without care for future; secondly, pollutants contaminated in the environments, for example, vegetables, food, soil, water, air, noise, and visual pollution; and thirdly, people do not know how to get rid of pollution, this is the reason why the environmental education has been established in Thailand. The details of the problems would be explained in separate as follows:—

Forest Resources

In the last several decades, Thailand has abundance of forest land, the country wide survey in 1950 showed a number of forest about 66.0

per cent. Then it dropped down to 52.62 per cent in 1961, drastic change to 38.61 per cent in 1973, and the final survey found 25.35 per cent in 1977 (Chunkao, 1981 b). Now, there is no further data available to inform the public, but it is expected to have forest land left less then 25 per cent. Those forest land are naturally localized on hilly rugged terrain upto the high mountains. The government has tried to keep those forest lands in by means of wildlife sanctuaries, national parks, national forest, preserve forest, watershed forest, and biosphere reserve. These ways of keeping these forest lands have been expected to maintain the forest in the long run. Measures and protection means have planned in effective by both the laws and its enforcement. Also, education programs have been added. When the forest has been tremendously decreased as mentioned before, the impacts would not be avoided one way or another, such as floods in wet season, drought in summer, sediment transport from highlands to lowlands, soil deterioration both on highlands and lowlands which introduced low soil productivity, and finally changing some ecosystems.

Agricultural Resources

After the people converted the forest to be cultivated land with old style technology, land had to be decreased in productivity. An example of low productivity was shown in Table 1 which would be explained that product found about 293 kg/rai (1 rai=1600 sq.m.), and increasing to be 309 kg/rai. This product seems low when it compares with other countries. In the same manner, after, high technology was put, the rice produce increased from 293 to 309 kg/rai, while the other countries showed high ranges of increase. In other word, the increase of rice product in Thailand is lower than the other Asian countries because rice field enlarged at land not to be suitable for rice growing. An increase of total areas of rice field made a decrease of an average value. In other words, an increase of rice field did not increase of its products per unit area (Chunkao, 1981 a).

There are a lot of crops that the people cultivated in the shifting area, such as cotton casava, beans, maize, and others. The total products in the whole country found increase but not increase per unit area. This means that the forest conversion to be cultivated land would be increased the national products but it decreased the products per unit area. This is the reason why the government has put an effort to promote the agricultural extension program to introduce an appropriate technology to find means how to increase the products per unit area.

Fisheries products showed in drastic decrease because of lack of education in conservation of the people. Report from Department of Fisheries found the decrease of catching as shown in Table 2. The decrease of fisheries products was caused by two main factors: firstly, more fishes were needed to feed an explosive population but never concerning with conservation concept; and secondly, growth rate decrease of fishes (Chunkao, 1981 b).

TABLE 1

Rice products of Asian countries as collected during 1968-1970 and 1974 (Division of Agricultural Economics, Ministry of Agriculture and Cooperatives)

Country	*Yield (kg./rai)*	
	1968-1970	*1974*
Japan	902	1000
Korea	687	1048
China	642	565
Malaysia	344	404
South Vietnam	329	—
Sri Lanka	389	—
Indonesia	315	404
Thailand	293	309
Pakistan	290	—
Burma	271	323

Agricultural Pollution

When the agricultural products were decreased the farmers could do two-ways: firstly, they must convert the forest to be cultivated land but now very few forest land left therefore they must turn to take their choice to the second way; and so the second way of doing of the farmers, they have to apply modern technology such as using fertilizers and spraying pesticides to increase their products. In the last decade, chemical fertilizers were imported increasingly from low quantity of 229,905 tons per annum and then getting to the peak of 915,222 tons per annum (Table 3). In the same procedure, pesticides were imported extremely increase from 5,991 tons per annum then getting to the peak

TABLE 2

Fisheries products as caught in the Gulf of Thailand as reported by Statistic Unit, Department of Fisheries, Ministry of Agriculture and Cooperatives

Year	*Amount of Catching (tons)*	*Catching Rate (kg/hr)*
1963	198,190	231.6
1964	320,614	225.6
1965	343,141	179.2
1966	363,842	131.8
1967	437,424	115.1
1968	513,380	105.9
1969	518,650	109.7
1970	530,890	94.4
1971	608,580	66.3
1972	704,511	63.1
1973	829,149	51.9
1974	600,263	57.7
1975	746,238	47.0
1976	575,332	57.2

of 20,065 tons per annum (Table 3). Unavoidedly, the pollutants from fertilizers and pesticides would introduce to contaminate in the environment, particularly in soils, air, water, agricultural products, even in the human bodies. The pollutants that found in the rural areas are included as heavy metals, pesticides, and some toxic substances. Also, there were some biological pollutants that surely contaminated in the environment such as coliform bacteria, nematode, blue green algae, and fungi.

Industrial Waste and Pollution

The government has promoted food preservation and can food industries in the rural areas. There are food industry more than 500 factories and more than 1000 factories of another industries all over the country, and they produce waste water from 5,000,000 to 24,574,000 cubic meters per annum (Chunkao, 1981 b). Undoubtedly, soil and water would receive waste water which contaminated pollutants as well as living organisms. There are a lot of reports that found heavy metals, pesticides, chemical-toxic substances, and living organisms in the environments.

TABLE 3

Fertilizers and pesticides imported to Thailand in the last 10 years (1971-80)

Year	*Fertilizers* (*tons*)	*Pesticides* (*tons*)
1971	229,905	5,991
1972	383,306	8,100
1973	399,365	8,524
1974	364,134	9,977
1975	153,910	8,213
1976	683,557	11,538
1977	915,222	15,623
1978	753,990	19,465
1979	683,748	20,065
1980	600,000	16,445

Source: Department of Agriculture, Ministry of Agriculture and Cooperatives.

In other words, the factories for producing the raw materials of agricultural products to be cane food or other types of preserved food usually introduced the pollution into the environments as in the same way as the heavy industries affecting into the environments in the rural areas. It would be said that industrial waste is another factor affecting the pollution in the rural areas. However, the casuality was reported annually about 300-500 people death and more than 3000 people were injured.

Environmental Education Programs

In general, the success of natural resources conservation in developed countries rested upon thorough understanding by citizens of the value of forests, soil, water, wildlife, and related resources to individuals and their communities and to their nation (Beard, 1948). Unfortunately, developing country such as Thailand, the people realize that natural resources belong to the public or to the community. This means that nothing else does not belong to some body else, anyone can take those natural resources any time they want to have it. In other words, people realize that public natural resources means no body occupied. Therefore, environmental education in Thailand has set aside three major concepts: firstly, to clearify the people understanding the natural resources belong to public or to everyone or to community, and they should keep it for ever; second one of the major needs is the clarification of the fundamental concepts of conservation; and finally, to provide the hazards of pollutants that are produced from the resources utilization by people to the people, particularly on-going processes of resources utilization. In order to accomplish those concepts, the government of Thailand has planned the environmental education programs by following UNESCO report (1978).

Curriculum of Formal Education Programs

In primary school, there is no independent course in environment but it integrates in the contents of the courses of science, physical health, and social science. For secondary school, the content of all courses to which the students enrolled still integrates some content of environment but school activities provided inside and outside school fields. Some schools have arranged the debating programs on environmental problems in order to put the concepts of environmental conservation to the students. For the teacher colleges, there is a course of environment available for the students, some school put it in the core course but some arrange it for elective course. Finally, the university levels mostly provide the core course, but some still arrange in erective course. However, some universities have provided the Master Degree of Science in Environmental Science or Environmental Studies such as Kasetsart University, Chulalongkorn University, Mahidol University, and Asian Institute of Technology.

Informal Education Programs

There are a lot of informal environmental education programs in Thailand. Those programs intended to contribute the environmental knowledge to all classes of people. They are as follows:

1. Radio programs
2. Television programs

3. Newspaper
4. Posters, Exhibition, and Demonstration
5. Movies and Slide Shows
6. Publications
7. Extension Works and Services
8. Seminars, Conferences, and Symposiums
9. Training Programs
    1. Administrators
    2. Educators
    3. Military and National Security Volunteers
    4. Volunteer Groups such as Boyscout, Girlscout, etc.
    5. Promotion of High Ranking Officers

All these programs have been available for the right time and the right place. Some time they have all programs in one place but another may have one program. According to the poverty, the programs of environmental education do not seem to be effective because of the ignorance of the rural people, or they are not interested in the mass media that had produced by the environmental educators. In other words, the programs of environmental education in Thailand do not reach through the finish line, and hopefully to be better in the near future. Hopefully, when the environment, education programs go hand in hand with rural development, the life quality of rural people would be improved.

References

1. Beard, W.P. 1948. Teaching Conservation: A Guide in Natural Resources Education. Washington, D.C.: Published by the American Forestry Association, 999 Seventeenth Street Northwest, 144p.

2. Chunkao, Kasem. 1981 a. Environmental Science. Graduate Committee in Environmental Science, Kasetsart University, Bangkok, 260 p. (Thai).

3. Chunkao, Kasem. 1981 b. Water and Pollution problems in Thailand. Environmental Interflow No. 4, Department of Conservation, Faculty of Forestry, Kasetsart University, Bangkok (Thai)

4. Dasmann, R.F. 1980. Ecodevelopment—An Ecological Perspective. Proceedings of the V the International Symposium of Tropical Ecology, 16-20 April 1979, Kuala Lumpur, Malaysia, p. 1331-1335.

5. UNESCO. 1978. Prospects. UNESCO Quarterly Review of Education, Vol. VIII, No. 4.

American Environmental Education in the Age of Accountability

CRAIG B. DAVIS* and THOMAS TANNER†

Introduction

One decade and a year after the first Earth Day, American environmental education has reached a critical phase in its development. Environmental educators are under increasing pressure to justify their existence. It is tempting to lay total blame for this uncomfortable state of affairs on the political and economic philosophies of the present Administration and Congress in Washington. It is true that the Reagan Administration and the Conservative Congress are not friends of the environment. Supply-side economics denies the finite nature of natural resources. States Rights policies cannot be expected to cope with environmental problems that are not constrained by state or even international boundaries. "Getting government off of the people's backs" by relaxing or eliminating many government regulations and standards threatens many of the hard-fought environmental legislation gains of the 1970s. But, we must realize that storm clouds were on the horizon before Ronald Reagan replaced Jimmy Carter in the White House.

The fervor that characterized the environmental movement during the early 1970s has abated, as environmental concerns have had to compete increasingly with other concerns: energy sufficiency, unemployment, inflation, and, recently, national defense. Many environmental programs in our schools have been struggling for survival as administrators cope with dwindling budgets. And, for the past two years, the U.S. Office of Environmental Education, created in 1970 with virtually unanimous support from the U.S. Congress, has failed to receive funding.

American environmental education has entered the "age of accountability". No longer will the label "environmental" insure the

---

*President, National Association for Environmental Education; Coordinator of Environmental Studies, Iowa State University, Ames, Iowa, U.S.A. 50011.

†Associate Professor of Environmental Studies and Education, Iowa State University, Ames, Iowa, U.S.A. 50011.

votes of legislators or government funding. It is time for environmental educators to reassess the objectives and techniques of environmental education. The environmental education of the 1970s was very successful at elevating the environmental awareness and concern of the American public. But, is the values-oriented environmental education of the 1970s adequate for the challenges of the 1980s?

In this paper, we will review the historical roots of American environmental education; assess its current status, successes, and failures; and offer some suggestions for reorienting environmental education for the challenges of the 1980s.

The Forerunners of Environmental Education

In the U.S., and perhaps in any nation, the history of environmental education (EE) and its antecedents is best understood when one views other aspects of the nation's past. The history of our young country is one of rather rapid expansion across a wilderness bountiful with natural resources: vast forests, exceptionally fertile prairies, rich mineral deposits, petroleum, great rivers, fisheries. Our settlement of this wilderness might have been less dramatic had it happened a millennium or two earlier. But occurring when it did, it marked us a nation of technological opportunists with the means to utilize these resources rapidly, and we sometimes destroyed them before moving on to new frontiers.

The Conservation Movement

Concern about dwindling natural resources kindled the development of the American Conservation Movement. The history of this movement can be divided into three periods (Stapp 1974, Swan 1975, Kirk 1977).

1. *The Awareness Period*—This period, apporoximately 1864-1900, was influenced by such astute and politically active writers as George Perkins Marsh (*Man and Nature*), John Muir (*The Mountains of California* and others), Jonn Wesley Powell (*Explorations of the Colorado River of the West and its Tributaries*), and John Burroughs, author of twenty nature books. The objective of the writing and teachings of this period was the replacement of the frontier ethic of resource exploitation with a new ethic, one favoring the conservation of natural resources.

2. The *Preservation Period*—From 1901 until approximately 1910,

the American Conservation Movement was dominated by the thinking and great influence of President Theodore Roosevelt. An avid outdoorsman and conservationist, Roosevelt increased by at least five times the amount of federally protected land, established the first wildlife sanctuaries, and created America's first conservation management agency, the U.S. Forest Service.

3. The *Management Period*—Started by Roosevelt, the management period extends to the present day. It has been marked by the development of government resource agencies such as the U.S. Soil Conservation Service, the U.S. Bureau of Land Management, and the U.S. Fish and Wildlife Service. Comparable management agencies were organized in each state. The objective of management programs has been the wise use of our natural resources.

Thus, the Conservation Movement started with an educational emphasis. Once the new conservation ethic began to take hold in our society, we developed a corps of professionals (the managers) who were to learn how to make the "ideal" of the conservation ethic a reality.

Of course the education effort did not grind to a halt with the onset of the management period. Indeed, the effectivenees of conservation education in this century is one of the major successes of the Conservation Movement.

This success can be attributed to the fact that educators and managers did not go their separate ways. Managers realized that they needed public support for their programs, and that to get this support, they had to communicate their findings and objectives to the public. The educational community could provide managers with this communication capability. Educators, on the other hand, realized that the field of resource management was changing fast, and they had to maintain contact with the managers if they wanted to stay abreast of developments.

The ultimate outgrowth of this mutual desire for communication was the creation of the Conservation Education Association (CEA). CEA's principal contribution to the Conservation Movement might very well be the fact that it provided for the successful blending of "process" and "content." Such blending has yet to develop in the Environmental Movement and its professional education society, the National Association for Environmental Education.

The Environmental Movement

The beginning of the environmental movement can be traced to Rachel Carson's 1962 book *Silent Spring*, which triggered unprecedented concern about toxic chemicals in our air, water, and soil. These concerns grew during the 1960s. The U.S. Government responded by passing landmark environmental legislation such as the Endangered Species Act, the Wilderness Preservation Act, and the National Environmental Policy Act, and by establishing the U.S. Environmental Protection Agency and the President's Council on Environmental Quality.

The American educational community also responded. Swan (1975) noted that environmental education "burst upon the scene" in 1969, and Kirk (1977) described environmental education as a "quantum leap" beyond its predecessor, conservation education. In the premier issue of The Journal of Environmental Education (1969), Editor Schoenfeld elucidated sixteen differences between environmental education (EE) and conservation education (CE). These included:

1. CE focused on forests, soil, water and other resources separately; EE pays due regard to their interaction.
2. CE had a rural and provincial emphasis; EE recognizes the urban, interstate, and international scope of many environmental problems.
3. CE justified conservation almost exclusively in economic terms; EE promotes ethics, aesthetics, and ecological integrity as equally valid criteria.
4. CE assumed the primacy of the professional resource manager, EE that of the citizen to whom the professional is responsible.
5. CE has promoted a nonquestioning attitude about national goals; EE supports a questioning and possible reordering of national priorities.

Environmental Education in the 1970s*

Environmental education was not the only environmental program to "burst upon the scene" in the late 1960s. The American educational community created a rich variety of environmentally oriented programs during this period. To understand what American environmental education is today and what its problems are, we must place it in context with these other environmental programs.

---

*The opinions presented in this and the next section are, for the most part, those of the first author.

Davis (1978) identified five categories of environmental programs:

(a) Environmental Science programs are mostly disciplinary or multidisciplinary approaches to the scientific and technical aspects of manipulating, modifying, or preserving our natural environment. Emphasis is generally placed on the physical sciences, on the ecologically-oriented biological sciences, on engineering and on statistical and computer modelling.

(b) Environmental engineering is a title that describes programs emphasizing the use of engineering concepts and methodologies in the design of structures, equipment, and systems that interface with or attempt to describe our environment. Environmental engineering is also used as a title for sanitary engineering programs.

(c) Environmental design programs emphasize the use of concepts and methodologies from architecture, landscape architecture, applied art, and certain social sciences in the design of environmentally sound structures, furnishing, and living systems. Occasionally, however, environmental design is used to describe programs of broader, less-obvious environmental import, such as the fine arts, dance, music, and literature.

(d) Environmental studies is an interdisciplinary, largely problem-focused approach to studying the nature and dynamics of our interaction with our natural/social environment. Environmental studies is strongly content oriented. Emphasis is on the quest for knowledge about and understanding of environmental systems and of the interactions between these systems and mankind's social and cultural systems.

(e) Environmental education is a broad designation used to describe programs dealing with the dissemination of knowledge about our environment and our impact upon it. Environmental education is primarily "delivery oriented". Content is, for the most part, taken as a "given" and emphasis is placed on developing effective methods and vehicles for presenting this content to school students and the general public.

Obviously, Americans use the term "environmental education" in a more restricted sense than it is used in some other parts of the world.

The relationship between environmental education on one hand and environmental science, engineering, design, and studies on the other becomes clearer if we further group the five categories into two broad philosophical camps:

(a) Environmental education has been oriented primarily toward increasing the environmental awareness of the public (children and adults).

(b) Environmental science, engineering, design, and studies, on the other hand, assume that environmental awareness (embryonic though it may be) already exists in our society. Attention is focused on producing the information and technology needed to improve environmental quality.

Because of these significant differences in philosophy, there was little communication and less interaction between environmental educators and workers in the other four categories during the 1970s. Environmental educators were intent on creating an environmental ethic, much as their predecessors in the awareness period of the late 1800s were intent on creating a conservation ethic. Their approach was process oriented; there was little need for interaction with content specialists. Davis (1981) has called this modern awareness phase *"first-generation environmental education."*

First-generation environmental education has been very productive and very successful. Working with funding from state, federal and private sources, environmental educators have created a rich variety of environmental education programs. One can even receive a doctoral degree in environmental education. Environmental education professionals have joined together to form their own professional society, the National Association for Environmental Education. They publish several newsletters and support a professional journal, The Journal of Environmental Education.

Perhaps the best indicator of the success of first generation environmental education is found in polls such as the one taken by pollster Louis Harris in September, 1981. This poll showed that by an overwhelming majority (80%), the American public does not want to see any relaxation in federal regulation of pollution (Conservation Report 29). His findings show that:

66 percent were opposed to relaxing pollution standards to allow power plants to burn higher sulfur content oil and coal,

61 percent rejected relaxation of "national air quality standards",

61 percent were against relaxing regulations protecting national park and wilderness areas from air pollution,

57 percent opposed postponing current utility emissions deadlines,

58 percent were against relaxing current auto pollution standards, and

54 percent rejected postponement of auto emissions deadlines.

Environmental educators can claim a share of the credit for creating this level of environmental awareness.

In spite of the successes achieved by first-generation EE, American environmental education is in trouble in 1981. It is faced with a government in Washington that is, at best, indifferent to environmental concerns. It is also faced with the economic realities of the times. In this age of accountability, environmental education is being asked to justify its existence. These external problems are serious. But, the biggest problems facing environmental education in 1981 are problems of its own making. These are problems that environmental educators must solve if environmental education is to remain a viable force in the years ahead.

What are these problems?

1. *For all of its emphasis on "process," environmental education has failed to establish its own pedagogical identity.* What is unique about the pedagogy of environmental education? How does environmental education differ from science education or social studies education?

Environmental educators claim that environmental education is interdisciplinary, that it is holistic in perspective, and that it should be diffused through all sectors of the school curriculum. Interdisciplinary implies joining the disciplines, creating a synthesis. This type of process is rare in environmental education. Holism means "all inclusive". If environmental education tries to be everything, it will be nothing (see Tanner 1974, pp. 22-29). The only one of the three characteristics claimed by environmental educators that seems to be functional is the last. Environmental education *is* generally diffused through the curriculum. Science teachers spend some time on environmental topics. Social studies teachers spend some time on environmental topics.

History teachers spend some time on environmental topics, etc., etc. But in diffusing EE through the curriculum, we have delegated the teaching to the science, social studies, and history teachers. So the question remains! How does environmental education differ from science education, etc., etc ?

Membership in the National Association for Environmental Education has declined steadily since 1978. Failure to define a unique identity for environmental education is at least partly responsible for this decline.

2. *Environmental education has failed to keep pace with developments in environmental science, engineering, design, and studies.* The goal of "first generation EE" has been values modification. Environmental educators adopted a few basic concepts from ecology (holism, stability and diversity, succession and climax, etc.), but their main interest was not in content. Process, or more precisely, hands-on experience was seen as the most effective way to change values. To a large extent, they were correct, and the pro-environment value system revealed in the Harris poll attests to the success of this approach.

But, in following this process approach, environmental educators diverged from their colleagues in environmental science, engineering, design, and studies. These content specialists have made great strides in improving our understanding of the environment and environmental problems. Some of the old concepts that were thought to be basic have been revised or replaced by new concepts (see Davis 1981). Findings from the content sctor should be incorporated into environmental education programs if these programs are to claim any degree of academic credibility.

3. *Environmental education is often considered to be "advocacy" rather than education.* This stems from its emphasis on values modification.

There is nothing wrong with advocacy in the classroom as long as the position being advocated is rationally defensible. Environmental educators shouldn't feel that they have to remain neutral in presenting all sides of every issue. But, they should be sure that they understand any issue on which they assume an advocacy position and provide their students the rationale that supports their position and refutes other positions.

Second Generation Environmental Education

The environmental education of the 1970s (first generation EE) created awareness and concern, but it also created a certain level of environmental sophistication. Americans are asking tough questions—questions about the desirability of development projects, about the toxic chemicals in our air and water, about the long-range implications of growth economics, and about the meaning of quality in the human existence. They are also questioning some of the messages that they received from environmentalists and some environmental educators during the 1970s. Are we really running out of just about every resource? Is crowding really all that detrimental to human well-being? Will CO_2 levels really alter world climates? Won't new technologies be found to fix environmental problems? And just how important are endangered species anyway?

These are tough questions about tough problems. Solving these problems in the 1980s and in decades to come will require the involvement of a well-informed citizenry. As Davis noted (1981), "there will be no role in the environmental polemics of the 1980s for those armed only with catch phrases, ill-framed ideas, and righteous indignation."

American environmental education must re-evaluate its priorities if it is to justify its existence in the 1980s. For we have, indeed, entered the "age of accountability": political accountability, fiscal accountability, and academic accountability.

A start toward a "second-generation EE" that would serve the needs of the 1980s would be the correction of the three "failures" mentioned earlier in this paper.

1. *A pedagogical challenge for second-generation EE would be the development of strategies and techniques for interdisciplinary teaching and study.*

   Environmental problems are too complex to be solved or even thoroughly understood by single discipline. Answers to these problems will not be found within a single discipline or in a set of disciplines. Answers will be found at the *interfaces* of relevant disciplines. Understanding these problems and searching for solutions will require sophisticated interdisciplinary efforts, efforts that focus on these interfaces. Unfortunately, techniques for this type of study and teaching are poorly developed. The need is there. Environmental education could fill it.

2. *Environmental education should become more rigorous in terms of content.*

   The best way to do this is to follow the example of the conservation educators who joined forces with managers earlier in this century. Environmental education must build effective avenues of communication with environmental science, engineering, design and studies. A first step in this direction has already been taken. One of the three Sections of the National Association for Environmental Education is the Environmental Studies Section.

3. *Environmental education should attempt to temper its advocacy image.*

   Our effectiveness in the 1980s and beyond will be determined, in part, by our professionalism. If we are perceived by policy makers, funding agencies, our students, and the general public as knee-jerk activists, we will influence few and receive support from even fewer. If, however, we develop rigorous programs based on fact and reason and assume advocacy positions only when these positions can be rationally supported, we will be perceived as professionals, and our messages might be heard.

If environmental education can move in these directions, it can survive the scrutiny of the age of accountability and play an important role in our struggle to protect the quality of our environment.

Literature Cited

Conservation Report No. 29. Oct. 23, 1981. National Wildlife Federation, 1412 16th Street, N.W., Washington, D.C.

Davis, Craig B. 1978. Interdisciplinary, problem-focused environmental studies. *In*: Davis, C.B. and A.B. Sacks, (Editors). *Current Issues in Environmental Education-IV*. pp. 130-133. ERIC/SMEAC. Columbus. 248 pp.

Davis, Craig B. 1981. Porous paradigms and intellectual cathedrals. *In:* Sacks, A.B., L.A. Iozzi, J. Schultz, and R. Wilke, (Editors). *Current Issues in Environmental Education and Environmental Studies*, Vol. 7. ERIC/SMEAC. Columbus. (in press).

Kirk, John J. 1977. The quantum theory of environmental education. *In*: McCabe, R., (Editor). *Current Issues in Environmental Education-III*. pp. 29-36. ERIC/SMEAC. Columbus. 272 pp.

Schoenfeld, Clay. 1969. What's New About Environmental Education? *The Journal of Environmental Education.* 1(1):1-4.

Stapp, William B. 1974. Historical settings of environmental education. *In:* Swan, J.A. and W.B. Stapp, (Editors). *Environmental Education: Strategies Toward a More Livable Future.* pp. 42-49. John Wiley & Sons, NY. 349 pp.

Swan, Malcolm. 1975. Forerunners of environmental education. *In:* McInnis, N. and D. Albrecht, (Editors). *What Makes Education Environmental?* pp. 4-20. Environmental Educators, Inc. and Data Courier, Inc. Washington and Louisville. 470 pp.

Tanner, Thomas. 1974. *Ecology, Environment, and Education.* Professional Educators Publications, Inc. Lincoln, Nebraska. 106 pp.

Fundamentals in Teacher Preparation and Curriculum Development for Environmental Education

T. CHELLIAH*

> We see around us growing evidence of man-made harm in many regions of the earth: dangerous levels of pollution in water, air, earth and living being; major and undesirable disturbances to the ecological balance of the biosphere; destruction and depletion of irreplaceable resources, and gross deficiencies harmful to the physical, mental and social health of man, in the man-made environment, particularly in the living and working environment.[1]

There has been a growing concern in Malaysia for the state of the nation's environment and for the necessity to combat its deterioration through concerted governmental and non-official action. The interest awakened on the subject of environmental pollution and degradation can be illustrated by the formation of bodies whose activities have been catalystic in their objectives and successful to the extent that they have provoked the government to formulate policies and legislation. The fundamental goals of the policies and legislation are two-fold: first to introduce changes in the physical, chemical and biological component of the environment; secondly, and perhaps more importantly, to induce changes in the perceptions and practices of people who use, manage and live in the environment. The people-oriented approach is a vital aspect of policy making since the sustentaction and further improvement of the environment from the physical to the aesthetic dimensions are only possible in a situation in which a fairly large percentage of the target population possesses environmental literacy—achieved through environmental education for some and environmental re-education for others.

This raises the crucial issue of the training and preparation of the

---

*Lecturer, Faculty of Education, Unversity of Malaya, Malaysia.

[1] United Nations Conference on the Human Environment, Stockholm, 5-6 June, 1972. "Draft Text of a Preamble and Principles of the Declaration of the Human Environment", Document A/Conf. 48/PC 16, p. 1.

citizens of the country to play their potential role in the intelligent management of the environment. What needs to be recognized in devising strategies for the implementation of policies related to citizen education on environmental matters is the uniqueness of the whole subject of environmental education as compared with traditional disciplines. It is imperative that the success of environmental education, whether formal or informal, will depend greatly upon the extent to which it is communicated to the target audience as being not merely relevant and meaningful, but indeed as necessary in order to balance the rapid development of an entire society with an increase in the quality of life led by the members of that society. Given this factor, it should not appear to be unusual that environmental education demands a fairly high degree of co-operation between educational bodies and the non-educational sector to achieve the desired relevance between environmental education as taught in the school and environmental issues and situations faced by the nation. Secondly, if schools are to be realistic in their teaching, it is vital to devise a method by which significant information held by non-educators can be passed on to curriculum planners in the education system. Thus the education system must be prepared, to a greater extent than presently to look outside its own resources if it is to contribute to the improvement of the national environmental situation. Thirdly, if environmental education is to be effective on a nation-wide basis, it cannot take place entirely within the schools. The non-educational sectors in the society will need to make facilities available to those who wish to pursue an out-of-school learning experience.

The goals of Environmental Education, as stated by UNESCO[2] and which have received general acceptance, are as follows:

1. to foster clear awareness of, and concern about economic, social, political and ecological interdependence in urban and rural areas;
2. to provide every person with opportunities to acquire the knowledge (values, attitudes, commitment) and skills needed to protect and improve the environment;
3. to create new patterns of behaviour of individuals, groups and society as a whole towards the environment.

How is the school, which bears only part of the responsibility, to translate these aims into realistic and practical objectives for the pupils? The development in the individual of awareness, competence, understanding and concern as it relates to the environment are difficult objectives to achieve. A close study of these objectives will reveal that there is a built-in progression from a form of learning which is mainly directed towards personal development to one which increasingly incorporates the needs of society. How is the teacher to translate stated aims and objectives into practical teaching-learning situations? Whilst there is abundant literature on teacher training programmes and curricula for various disciplines, there is a relative paucity in the work specifically carried out on teacher preparation for environmental education, a situation that can be attributed to either the relative newness of the subject or to the novel nature of this non-traditional subject area.

---

[2] UNESCO, *Trends in Environmental Education*, Paris, Unesco, 1977.

In as far as the teaching of environmental education at school level goes, the primary challenges arise from the inter-disciplinary and intra-disciplinary characteristics of the subject. They are also its most attractive aspect since they enable the subject the greatest degree of flexible adaptation in a curriculum. It is one subject to which all disciplines and bodies of knowledge contribute, in varying degrees, to provide it with its foundation. The nature of its concerns takes the subject into a rapidly expanding field in which new information and data are daily generated by the economic and social transformation of societies experiencing unprecedented material growth. It is, in addition, a subject intimately related to life processes and hence moral and material aspects of man's existence and survival on this planet. Finally, it occupies the undisputed position of being a natural link not merely between the biological and the physical sciences, but equally between the sciences and the humanities in general.

It would be evident from the remarks above that it is rather impossible to view environmental education in a vaccum, and its study or teaching undertaken in a manner unrelated to other disciplines. The nature of environmental education demands that teachers of the subject receive specialized training; any impression that suggests that a generalized training is sufficient equipment for one to become an environmental education teacher is a misconception.

It is a fundamental fact that the subject can only be handed well if there is specific and in-depth focus on the content, method of teaching and evaluation techniques. Knowledge acquired in regular academic courses does not by itself fulfil the needs of the environmental education teachers. In a study carried out amongst university graduates enrolled in a pre-service teacher training programme, it was illustrated that even science graduates with an ecology background were rather inadequate in their comprehensive of environmental issues and their socio-cultural economic interrelationships.[3] It is the general practice in teacher preparation programmes of most other subjects to address themselves to the methodoly and evalution phases. However, in the case of environmental education, its multidisciplinary nature requires that the content or body of knowledge be first determined before appropriate skills can be developed to teach and update its content. The methodology has to be geared to not merely the teaching of theories and principles, but has to include the practical application of the knowledge to real and on-going activities. It is this aspect of the subject that requires the extention of in-school instruction to specifically selected out-of-school programmes. The final phase of evaluation can only be prepared when it has been clearly determined what fact is being evaluated: the cognitive learning dimension only or additional aspects of the affective domain.

The relevant questions that need to be asked when planning for teacher preparation in environmental education are as follows:

1. Why should environmental education be taught?
2. What sort of environmental education should be taught?
3. At what level should it be taught?
4. How should it be taught?
5. How should environmental education be balanced with other subjects?
6. How can one integrate environmental concepts into the teaching of other subjects?
7. Need the teacher understand the current socio-economic trends faced by a particular society and the nature of life that his pupils lead?
8. How can the teacher develop his own sensitivity to the contents of this subject?
9. What methods and strategies must the teacher employ to be effective for in and out of the classroom situations?

[3] Chelliah, T., "Training of Teachers with Science or Humanities Background for Environmental Education: A Malaysian Case Study", *Environmental Education and Information*, 1981, Vol. 1, No. 2, pp. 95 107.

10. What is the relationship between the school and society?

11. How can the teacher assist the pupils understand the change occurring around them?

12. How is the teacher to instill in the pupils social consciousness with respect to environmental issues?

13. How can the teacher encourage a learner-learning dimension in preference to teacher-teaching or learner-listening practices?

It is true that even when given the constraints of a school system structured on a system of individual and compartmentalized subjects that stress examinations at the end of tunnel,[4] there is the possibility that environmental related topics can be dealt within each subject area, without giving it an inter-disciplinary character. But caution has to be exercised in the advocation of this approach because of its obvious limitations. For example, teachers of geography and biology can, in most cases, conveniently include environmental issues, but most of them will be hard put to or lack the capacity to handle issues such as economic, aesthetic, political or moral aspects within the traditional confines of their subjects. It is only through coordinated team effort with teachers from other disciplines that will enable the presentation of environmental issues in an organic and meaningful method.

The effectiveness of environmental education teaching-learning can be enhanced if the examination procedure are reorientated to exclude rote learning and mere regurgitation of facts in favour of developing skills in the application, analysis, synthesis and evaluation leading to scientific and systematic skill training. Also the myth that only the science-stream students can undertake studies in environmental education should be discarded. A pre-service teacher training programme has been successfully run at the Faculty of Education, University of Malaya for the past three years where graduates with humanities background have been trained to handle environmental education at the secondary school level.[5]

[4] "A person afflicted with this symptom sees only the light at the end of the tunnel—his goal—and he perceives nothing of what is not either side of him at the present." Saveland, Robert N. (ed.), *Handbook on Environmental Education*, John, Wiley & Sons, 1976, p. 1.

[5] Chelliah, T., "A Malaysian Experimental Programme: Environmental Education training for teachers with a background in the humanities", Bulletin of the UNESCO Regional Office for Education in Asia and the Pacific, *Environmental Education in Asia and the Pacific*, June 1981, pp. 271-282.

In order to achieve the above, the following conditions will have to be satisfied:

1. the teacher has to be thoroughly familier with the topics in the subject,
2. the teacher has to be sensitive to environmental issues to be able to recognize its relationship to specific topics,
3. the teacher has to be well-equipped with teaching techniques and methodology,
4. the teacher has to be aware of the resources available to aid his teaching,
5. there must be sufficient time allocated for the topic,
6. the syllabus must be flexible enough to incorporate the new content and provide opportunity for change,
7. the conditions imposed by the examination must be flexible and accommodating, and
8. the recruitment and training of teachers for environmental education must take into account the particular value and knowledge of urban-recruited and rural-recruited teachers for teaching in either urban or rural areas as the case might be.

It has been argued that these requirements are so stringent that in most cases the current system had often tended to discourage environmental teaching. For example, it has been suggested that "colonial type formal school" does not offer an ideal framework for environmental education, for it "alienates" the pupils, provides them a "fragmented knowledge" and prevents the child and the adolescent from achieving a "comprehensive view" of objects and phenomena. A UNEP report stresses that "it is not enough simply to develop curricula for environmental education within the framework of this type of school, but rather reforms of the formal education system must be undertaken on a regional scale in order to give environmental education its true place."[6]

The line of thinking reflects the current trend in curriculum development, that is to adopt a holistic approach. It advocates that a single concept or theme be studied from many complementary view points. The very nature of environmental education lends itself comfortably to this approach since no one discipline can claim priority over others in this unique field. Its multi-disciplinary nature is extermely difficult to quantify, and it can hardly be described comprehensively within a single subject nor can it be easily compartmentalized. The development of interdisciplinary studies has shown that environment can be studied through the cooperative effort of several and selected disciplines.[7] Illustrations of topies that can be utilized for appropriate unification in approach are energy, conservation, natural resourses, population food, leisure and recreation, etc. Disciplines that have such unifying capacity are biochemistry, geophysics, socio-economics, to name a few.

---

[6] "Review of the area environmental education and training", *Report of the Executive Director, United Nations Environmental Project* (UNEP), Report No. 1.

The trend toward the adoption of the holistic or thematic approach should gradually replace the traditional compartmentalized approach to the teaching of concepts under such strict labels as physics, biology, chemistry, geography, mathematics, etc. Many countries are now moving away from an orthodox system in favour of a logical holistic approach. The Malaysian example of this thinking is the Integrated Science Programme for the lower and upper secondary classes. It seems to adopt a holistic approach by dissolving the compartmentalized character of science teaching and thus help the child understand better the concept of science as a whole. The programme being still experimental, Physics, Chemistry and Biology are, however, presently combined with little attempt to actually present the content in strictly holistic or thematic concepts; they do exist at times as individually recognizable subject topics as was previously the case in the separate science curricula. This weakness in curriculum develepment can encourage, if not checked, the perpetuation of compartmentalization in the teaching and learning of science. But an important beginning in the right direction is underway.

It would seem in summary, that some of the practical pre-requisites for an environmental education programme should be:

1. the design of syllabii and overall programmes of study to ensure suitability of content,
2. the provision, at suitable stages, of opportunities for all pupils,

---

[7] For further discussion on why this interdisciplinary coordination must become the rule rather than the exception in education, see Terry, Mark, Teaching for Survival, A Handbook for Environmental Education, Ballantial Books, Inc., 1971, Part Three, Chapter One.

  (a) to study and discuss environmental issues
  (b) to become actively involved where appropriate,

3. adjustment of the time-table to provide opportunities for a measure of co-operative teaching, and to permit a proportion of the pupils learning experience to be undertaken out of schools,

4. the designation of a trained member of staff to have responsibility for planning and co-ordination.

The Role of Research and Development Institutions in Environmental Education

S.H.C. de SILVA*

Development is an elusive term. In the context of present usage it means technological, industrial and agricultural advancement. Research and Development (R & D) institutions are the offspring of Development processes first witnessed in the West, later in the lesser developed countries (L.D.C.).

Technological advancement, 'per se' was the result of national aspirations to possess superior 'know how', a 'sine qua non' for a country, both in peace and in war. The hunger for this 'know how' covered the entire spectrum of human activity, from agriculture to industry, nuclear power to space exploration.

In the 'free' world large companies and multinational corporations proliferated in manufacturing items needed by man for his food, clothing, shelter and leisure. R & D institutions were set up by these organisations as competition was high, in order to further refine and produce more economically and maximise production. R & D institutions also acted as an inspector of quality control. Charged with these functions (R & D) attracted the elite of graduates by offering higher remuneration and other perks. The same situation prevailed in the socialist set-up where scientists and technologists enjoy more privileges than the proletariat.

(R & D) have thus carved out a niche for their class both in the capitalist and socialist society. Optimising production be it automobile engines, tractors, weedicide or pesticide or fuel oil (R & D) institutions worked untiringly and ceaselessly. With the advent of environmental pollution and ecological disasters of the past 2 decades R & D institutions received a new fillip and new direction. They had to produce cleaner engines that exhaled less toxic gases, selective pesticides and weedicides and noiseless tractors, low sulfer fuels, etc. Factory effluents had to be cleaned before release to rivers and lakes to prevent cumulative toxins endanger agriculture, fish culture and human beings.

---

*Senior Deputy Director Irrigation, Sri Lanka.

Reorientation of (R & D) objectives took an inordinately long time. The former thrust of maximising output was diverted to maintain cleaner environment whilst maximising output and the world had to witness several catastrophic events before the change, but once the deleterious effects of environmental disruption were realised (R & D) institutions had to gear themselves for this onerous task though it was a sacrifice on the company profit margin.

R & D institutions were located in close proximity to the headquarters of the company or the multi-national corporation as they were under close surveillance of the management. These institutions attracted young scientists and technologists from the developing countries by better salaries, and prospects of fulfilling their research programs which the developing country could not afford. In some cases those offered post-graduate study scholarship opted to stay in host country after completion of such study.

R & D institutions in the developing country had to spend their energies to staff themselves. This was accentuated also by policy changes with change of governments or change of direction in institution itself providing and leading to an exodus-Brain Drain.

R & D institutions in extreme cases had to resort to employ expatriate or other non-nationals even in non-sophisticated technologies as bio gas, wind energy and solar energy installations. A feature that has been observed in R & D institutions in Sri Lanka was that activity if any was in spurts. With change of management occasional spurt of intense activity was followed by long dormant period. This was sometimes due to lack of funds or breakdown of sophisticated instruments and without avenues of foreign exchange for repair or replacement.

There are 3 R & D institutions in Sri Lanka covering the main agricultural produce of Tea, Rubber and Coconut. They have fared satisfactorily in the sense other L.D.C. have performed. The Paddy Research Units have discovered higher yielding strains. All these are Government owned or sponsored. The Irrigation Department (R & D) Unit dates back to the last 4 decades and has serviced departmental needs subject to the constraints already enumerated.

Lack of continuity of policy, staff changes, budgetary cuts on expenditure are eroding into the R & D body in general and is a malaise to be dreaded. What is the role of R & D institutions on Environmental Education under this set-up? Can they influence government policy beyond making pronouncements on the possible hazards?

In developing countries environmental signals are treated with the scant respect.

Take for instance the submarine coral mining on the shore and foreshore of Sri Lanka. Despite frantic calls to stop the ecological disaster and threat to the coast the mining goes apace, as it is a livelihood for thousands and an essential service for construction industry by supply of lime.

Deforestation of the fragile montane areas goes on, undaunted by the cry of the ecologist against soil erosion, flash floods and landslides. For there is no alternate cheap source of fuel or timber for construction. Even estate boilers are fired with firewood as oil prices sky rocket.

Pollution of rivers and streams goes unabated despite the environmental hazard proclaimed. Faecal pollution of city streams and canals goes on at an alarming rate for there is no alternative to Colombo's one million population served by an archaic sewerage systems constructed when the city had only 200,000 folks. Human life and waste have reached a balance in the slums, for whatever amelioration of conditions is eclipsed by increasing population. The case of Chandigarh, India, a city moulded by Le Corbusier has reversed all his design criteria with a cancerous growth of slumland.

What is the contribution of R & D institutions under such circumstances? Beyond creating an awareness in the minds of men and the more gullible in schools and colleges, the prospects are gloomy for the developing countries.

The only 'modus operandi' for R & D institutions will be to propagate an appropriate technology using non-polluting energy sources and maximising labour output.

This is the path of salvation for third world countries to solve unemployment as well as develop themselves without the environmental disruption experienced in the West. Transfer of technology is no solution either, with soaring unemployment.

One may say that is not *development* for which industrial nations provide aid or the lending agencies 'loans'. But this course of action will redeem future generations from perpetual servicing of debt incurred by the present generation in the name of development.

Sacred and Profane—Touching the World's Body: The Role of the Humanities in Environmental Studies

DR. ARTHUR B. SACKS*

"Your Place or Mine"

You old apples,
How many springs
Have you flowered
White
And green
Going crazy
With motion?
How many summers' fruit
Have ripened
And dropped
For the grey squirrels
To harvest,
Awed by an
Abundance
Even they cannot fathom?
Apples not good for eating,
Apples not good for
Saucing or wining,
Apples good only
For picking
Up
When there is
Time
Of which there is never enough.
Your branches
Ever marauding
Across my yard
Make it useless;

---

*Administrator of Academic Programs, Institute for Environmental Studies, University of Wisconsin-Madison, Madison, Wisconsin 53706

Once the apples come
I can barely pass
Beneath your branches
Bowed heavy with hard green, wormy crabs
To see my meek garden
Your acid fruit has rendered fruitless.
Should I not do
Something about your
Lush arrogance?
Should I not take
Saw in hand
And transform
Your unbridled selfishness
Into stove heat
For a cold winter's eve?
Why, even after a morning
And an afternoon,
And another morning
Of picking bad fruit,
Why, even when the blood
Runs hot
To remedy your unlawful
Squatting in my yard
So it may be
Returned to the rightful owner
Of land
Signed and sealed
If not yet delivered
From the bank,
Why then do I reach
For my already sweatsoaked bandana
And not an ax?
Is it the history
Of your roots
Or the scars from ice storms
And wind storms
And rains
That let your
Magic work so heavily
Upon this land,
Subverting my mystery,
And claiming this patch of earth
For you and not my picnic table?

In thinking of ways to introduce the subject of this paper, the role of the humanities in interdisciplinary environmental studies, I pondered the risks and the advantages of beginning obliquely, if somewhat flamboyantly, with the recitation of a poem I had written. The risks: The poem, composed in the American idiom and featuring a singularly American "problem"—lush abundance—and recited only once before an international audience, may be easily misunderstood. In fact, there is the real risk that the act of reading a poem, any poem, to an assemblage of scholars, scientists, educators, and administrators who have gathered to discuss serious issues of environmental education and how environmental education relates to critical environmental problems involving survival, may be regarded as misguided aestheticism if not effete pomposity. *The advantages*: Perhaps by so beginning, I will have awakened the senses of those at hand, and by so doing sharpened a curiosity to learn more about the role the humanities play in understanding our conceptions and uses of the environment. But, more importantly, if in reciting the poem I will have touched the audience, allowed them to experience the flow of words and sentiment, I will have been able to illustrate one of the key messages of this presentation. I will return to all this later.

But first, as Davis (1978) has shown, there is a need to distinguish environmental studies as a field of inquiry from the array of academic programs which have "environmental" in their titles: environmental science, environmental engineering, environmental design, environmental communications, and environmental education. Some definitions (Davis, 1978) will help:

1. *Environmental Science.* The base of such programs is multidisciplinary science, usually the physical and earth sciences and the biological sciences. Its goal is the application of multidisciplinary science for the resolution of environmental problems through the wise manipulation and modification of man-made systems. Cultural and social aspects of environmental problems and issues tend to be understated in these programs.

2. *Environmental Engineering.* As the title suggests, the emphasis of such programs is on the use of engineering concepts and methodologies to design and organize systems, structures, and devices to treat and control specific technical environmental problems: e.g., solid waste disposal; hazardous waste disposal; effluent modulation, modification; and control.

3. *Environmental Design.* A term applied to programs that use

the concepts and methodologies drawn from architecture, landscape architecture, applied art, and certain behavioral sciences in the design of communities, structures, and living systems that are "in tune with nature": the Ian McHarg School.

4. *Environmental Communications.* The delivery of environmental information through the media. Such programs draw largely upon the fields of journalism, mass communications, and agricultural journalism. The goal of such programs is to train individuals to convey sound, technically accurate information about the environment to the public.

5. *Environmental Education.* A broad designation that, in the U.S., has come to refer to programs dealing with the instructional dissemination of knowledge about the environment and human effects on it. Largely, the term has come to mean instruction at the kindergarten through high school levels. As such, environmental education deals with a body of existing knowledge, delivering such knowledge by developing sound methods and modes of content transfer. At college and university levels environmental education primarily consists of the training of prospective teachers how to teach school children about the environment.

6. *Environmental Studies.* As Bryson (1976) has indicated, the primary focus of environmental studies is the "interdisciplinary study of the man-environment system," the study of the interactions of people, resources, and technology. In Cairn's (1980) words, the goal is to go "beyond reductionism", to understand and integrate existing and new knowledge across the disciplinary boundaries within the natural sciences, the methodological sciences, the social sciences, and the humanities. The emphasis is on the pursuit of knowledge about the interrelations of biological and physical phenomena and cultural and social systems. As Davis (1978) has noted, environmental studies is

> "..... a field of scholarly pursuit. Faculty members engaged in environmental studies are...keenly interested in examining the body of knowledge, sifting it, resorting it, and examining it again with the hope and expectation that their efforts will shed some light on the interrelationship of man, culture, society, and the environment. It is this

> pursuit of knowledge that is the true *raison d'etre* for the field of environmental studies."

Environmental studies alone is broad enough conceptually to place a high priority on understanding perceptions, attitudes, values, beliefs, ethics, and non-quantifiable influences upon judgment, and the role of these elements in shaping the conscious processes of environmental decision making. Environmental studies is also interested in understanding the ingrained cultural paradigms that are so inherent that they often fail to be recognized as significant, paradigms which create a world view that underlies human use and treatment of the environment.

Attitudes, values, beliefs, and the like are properly the realm of the humanities. Though such factors are subject to rigorous analysis and study, they are largely qualitative in nature and not readily analyzable by the usual modes of science. The first role of the humanities in environmental studies is to apply their unique modes of intellectual inquiry to *uncover*, to *understand* the meaning and significance of the elusive, non-quantifiable aspects of culture which influence human action that directly or indirectly affect the environment. By definition, such aspects have temporal and spatial variables: U.S. attitudes toward nature are not the same today as they were circa 1800. Nor is there a global unanimity of outlook: developing nations can be expected to perceive certain environmental issues differently from industrialized super powers. In his seminal article, Hare (1970) makes this very point while discussing the role of the Western university in confronting environmental problems:

> "We have to admit that our viewpoint is that of Western industrialized society, and that we shall be working out our program (for the university) in the light of that society's past mistakes and assumptions for its own future. This implies (i) that the Western value system is of direct concern to us, and that humanists ought to be deeply involved in environmental studies; and (ii) that we must not make the mistake of assuming that other societies have similar relations with environment, nor should they be expected to have Westernized ambitions for the future. Rather, in fact, the reverse. It should be a major objective of those involved in environmental studies to alter the Western outlook on such questions. We shall solve our environmental problems only by deep seated changes in society itself."

This lack of global unanimity created by differences in cultures, political and social needs, and history give rise to very different notions of what constitutes "quality of life," what constitutes risk, and what risks are "acceptable." Cultural differences must be comprehended and respected if actions are to be understood and if positive change is to occur.

If the primary role of the humanities is to *uncover* meaning, to help create an understanding of the man-environment system, the humanities have another role—to *convey* meaning, to transmit it through felt *experience*. The humanities not only allow us to *learn* about attitudes, values, beliefs, etc., but study of the humanities provides an opportunity for us to *experience* them, in fact, be transformed by them.

I have moved along very rapidly, and I fear that I may have gotten to the moral of the story before I have presented the narrative. I would like at this point, therefore, to make the case that the study of attitudes, values, beliefs, and the like is in fact an essential element of interdisciplinary environmental studies. And, hopefully, by the close of these remarks the relevance of the poem recited at the opening will become apparent.

Any attempt to understand the origins of the environmental crisis must consider the structure of Western values and beliefs, for it has been the industrialized, technological West that has propelled the globe so quickly and completely to a common environmental future.

Whether or not one wholly embraces Lynn White's (1967) much discussed thesis that the Judeo-Christian tradition has largely been responsible for generating the environmental crisis because of its premise that God has given man dominion over bird, beast, and flower, one cannot argue his point that "What people do about their ecology depends on what they think about themseleves in relation to things around them. Human ecology is deeply conditioned by beliefs about our nature and destiny—that is, by religion." And, if White overlooks the notion that in Judeo-Christian tradition, man is also commanded to operate within God's laws and be a wise steward of the world he dominates, still there is little doubt that there are elements within Western culture which have chosen to operate on the strength of dominion rather than stewardship and cooperation.

Perhaps more fundamental then the particular Judeo-Christian religious orientation has been the underlying position of God in the universe. American poet Wendell Berry (1970) elaborates:

"...perhaps the great disaster of human history is one that hap-

> pened to or within religion: That is the conceptual division between the holy and the world, the excerpting of the Creator from the Creation. . . . If God was not in the world, then obviously the world was a thing of inferior importance, or of no importance at all. Those who were disposed to exploit it were thus free to do so. And this split in public attitudes was inevitably mirrored in the lives of individuals: a man could aspire to Heaven with his mind and his heart while destroying the earth, and his fellow men, with his hands."

With the end of animism in the West, with the flight of the gods from the world, the distinction between sacred and profane was sealed. And although it may be a simplification, when the gods departed the world nature became useable, expendable. When you no longer pray to a lake you are free to foul it. There are those whose sights have shifted beyond the profane to the sacred, those who have regarded the world as a hateful obstacle to salvation. For these, life is to be endured, withstood, not enjoyed and protected. In the extreme, to be a part of the world, to touch and be touched by the world, is nothing less than to confirm one's profanity, the earthly state in which one is trapped till liberated by death.

If we go beyond religious perceptions and how they have helped to create the environmental realities of the 20th century, we are struck by other significant perceptions about man's basic orientation to the world. Humanity in the Western world has tended to define itself as outside of nature, alienated and divorced from it. We hear repeatedly of distinctions between humans and the natural world, as if they were not part of nature. The distinction is often articulated as people and the built world—the artificial world—working against nature, the world of trees and wildlife and "natural" processes. Man, artificer, creator has had difficulty considering himself an animal among others, has had the need to regard himself apart from this lower world; man is described as residing on a higher plane, touching but not *being* in nature. And, in fact, Western eyes have regarded man as the controller, the tamer of a nature that threatens man through the physical chaos of storms and drought, the anarchy of pestilence and disease, the harshness of physical landscapes which prevent territorial expansion or social growth, even through the turbulence of emotions unchecked. Nash (1967) has made this point about the perceptions of the wilderness as a chaotic malignity experienced by early European settlers desiring the stability, the order, and the familiarity of the landscapes of their homelands.

Whether such perceptions have or have not their roots in the Judeo-

Christian tradition or in the perception of a universe divided between sacred and profane elements is an academic argument. Regardless, such a sense of alienation, such a failure to recognize the interdependence of man and nature had led to self-destructive behavior through environmental degradation.

Perceptions which are so inextricably bound to culture seem to be at the heart of the matter. Until recent history man has lacked the scientific knowledge and the technology to help him understand the complexity of the interconnections of man and nature. Although throughout time man has recognized his vulnerability at the hands of the elements, until recently he has not fully comprehended the ways he can and does affect the world and the life around him. However, even in wholly modern, technological societies possessing scientific knowledge and clear evidence that human action X will lead to environmental response Y, the creation of sound public policy is dependent upon perceptions, values, and beliefs: e.g., the perception of political and economic realities; the belief in what is right or wrong, what man should or should not do; ultimately the perception of what is real, in fact, the perception of what is. In the face of the same data some will say there is no problem; many will debate the severity of the problem if it is recognized; some will say that there is a problem but it is not mine or ours; others will say that there is a problem but the solution for it is just around the corner.

Every culture across time has had underlying assumptions other than explicitly religious ones, other than assumptions about humankind's basic orientation to nature which have shaped human perception and resultant treatment of the environment. A mention of two closely related cultural assumptions which have been paradigmatic for the West will help illustrate this point.

The Myth of Progress. Pervasive in Western culture is the myth that progress is both good and inevitable. Glacken (1970) has observed:

> "The struggle with and the control over nature were ways of depicting the progress of civilization. In its material aspects, civilization meant this—the purposive changes in nature, the overcoming of natural obstacles by bridges, drainage, roads, and later by railroads and air and sea routes."

These signs of technological advance continue to thrive: space travel; the defeat of distance through the speed of computerized telecommunications, etc. And in the West other signs of human progress abound: general literacy; a high standard of living; freedom from epidemic; the steady advance of basic science and technology. There can be little doubt that such phenomena have liberated some humans from want, have allowed them to control their world in ways that could not have been dreamed of only 100 years ago. However, the faith in progress, either in social terms or in terms of human emotional development, is one which requires diligently ignoring the failures of humanity. The true believer in progress tends not to ask the question, "progress at the expense of whom or what?" Problems of resource scarcity, the global problems created by pollution, the drain by a few nations on the resources of the many, unexpected outcomes of technological advance (e.g.. the DDT case), the fear that nuclear weaponry may put an end to progress and our environmental problems all at once, have undercut the myth of progress.

The Myth of Technical Fix. However, an offshoot of the myth of progress, the myth of the technical fix, stands ready to shore up the weakening faith. If some have foregone the claim that humanity has progressed emotionally, spiritually, or morally, the faith in technical solutions to human and environmental problems to have been embraced more tenaciously. As the myth goes, a technical solution for such problems will be produced by the ingenuity, the creativity of the human imagination and intellect. This myth has allowed the continual degradation of the environment to persist: if we denude the forests, somehow, the myth goes, science will develop a faster growing tree to repopulate them; if we contaminate our groundwater with toxic and hazardous wastes, we will develop a system to locate the problem, then isolate and neutralize it.

Faith in progress and technology plays a significant role in environmental policymaking, and this is where such attitudes and values can be most damaging. As Murdoch and Connell (1970) have asserted, one of the tasks of the ecologist, of the environmental educator, is "to dispel this faith in technology." The policymaker must be trained in such a fashion that he or she will have the tools to understand the trade offs, have the ability to hear out equally prominent scientists arguing on one side or another of an issue, and be able to make rational judgments without being moved by an unstated but underlying faith in technology. Policymakers must be aware of their cultural biases, the roots of their perceptions and their basic assumptions about the world, for their decisions have consequences that extend to posterity. They must be aware, as must the citizenry who elect them, that such myths have come and gone in cultures, and that cultures must be resilient and adaptive, ready to redirect themselves for survival.

We must be ready for contemporary myths to come tumbling down as they have done throughout time. One illustration of a demolished myth will make the point. Nash (1967), Glacken (1970), Montcrief (1970), and others have pointed to the American myth of the inexhaustibility of resources. To the first settlers in the Americas, the vast wilderness seemed endless and threatening, and the frontier proffered an almost unfathomable abundance. Until that frontier closed there was not the sense that what was would no longer be, that forest, mineral, water, wildlife, and land resources would not continue to stretch to the horizon. The early spokespersons for the burgeoning conservation movement had difficulty convincing the commonwealth that there was a need to preserve the wild, to plan for a day when wilderness would exist only as islands in an industrialized landscape. It has only been over the past 20-30 years, after a considerable educational effort and the experience of the 1973 OPEC oil embargo, that the popular Western imagination has begun fully to confront the notion that our resources are limited. Such a shift in public perception, the death of myth, is a prerequisite for sensible collective action.

knowledge of cultures and their myths, knowledge of the cultural basis of belief is essential for an understanding of the history of humanity's use and abuse of the environment. It is also essential for understanding individual action and for understanding current policy, and perhaps for predicting, if not directing, future policy decisions. As noted at the outset, this is the province of the humanities, that dark mirror which reflects what it means to be human. As a recent report by the U.S. Commission on the Humanities (1980) has observed,

> "The essence of the humanities is a spirit or an attitude toward humanity. They show how the individual is autonomous and at the same time bound, in the ligatures of language and history, to humankind across time and throughout the world. The humanities are an important measure of the values and aspirations of society."

This report goes on to say that a citizenry educated in the humanities is better able to "use their scientific and technical achievements responsibly because they see the connections among science, technology, and humanity."

Traditionally, the fields of knowledge viewed as comprising the humanities have been literature, languages, history and philosophy. Increasingly, criticism —of literature, the performing arts, and the plastic arts—and film study have been treated as discrete fields belonging to the humanities. Such fields, or at least elements of them, should therefore be included in curricula designed for the serious interdisciplinary study of the environment. As a window onto the cultural landscape the humanities provide valuable understanding of causality and commonality. It is primarily for this reason that courses on the humanistic perspective on the environment, environmental ethics, and the natural history of man are included in the curriculum of the Institute for Environmental Studies at the University of Wisconsin-Madison.

The study of the humanities involves more than the analysis of meaning, and the humanities, through the study of literature and the arts especially, involve experiencing the world so that our awareness, our interest, and our concern is heightened. American poet Wendell Berry (1970) argues this convincingly, remarking that if humans are truly to understand their interdependence with other natural phenomena, such meaning.

> ". . . must not only be written and publicized and learned, but understood, *felt*, accommodated to the particularities of the lives of particular people. If it is well to consider the needs of the earth as one's own needs, that must be carried beyond abstraction into the specific relation between each man and his place in the world. There must be new contact between men and the earth; the earth must be newly seen and heard and heard and felt and smelled and tasted; there must be a renewal of the wisdom that comes with knowing clearly the pain and the pleasure and the risk and the responsibility of being alive in the world."

And so, there should be a place in the study of the environment for poetry, fiction, drama, film, for such study allows us to touch the world's body, to deepen our value of it, and allows us to experience the sacred amid the profane, so that we can conclude with Marcus Aurelius that "all things are interwoven each with (the) other: the tie is sacred, and nothing or next to nothing is alien to aught else."*

Thus, we return to my backyard and those infernal, mindless apple trees whose drive to survive and renew their species is as persistent as man's sometimes desire to subjugate nature to his will. The poem is one way of touching a world that we have the power to destroy or preserve. Let us try to stay the ax.

---

*The scope of this paper does not permit the citation of examples from specific genres that would be useful and appropriate in the environmental studies context.

References

Berry, Wendell. "A Secular Pilgrimage," *The Hudson Review.* Autumn, 1970, v. XXIII, n. 3, pp. 401-424.

Bryson, Reid A. "The Environment, the University, and the Future." The Alcoa Distinguished Lecture, Texas Tech University, Lubbock, Texas, 9 February 1976.

Cairns, John Jr. "Beyond Reductionism," *The Virginia Tech Magazine,* Sept./Oct. 1980, v. 3, n. 1, pp. 31-32.

Commission on the Humanities. *The Humanities in American Life.* Berkeley: University of California Press, 1980.

Davis, Craig B. "Interdisciplinary Problem-Focused Environmental Studies," *Current Issues in Environmental Education IV,* Craig B. Davis and Arthur B. Sacks, Editors. Columbus, Ohio: ERIC Clearinghouse for Science, Mathematics, and Environmental Education, December, 1978, pp. 130-136.

Glacken, Clarence J. "Man Against Nature: An Outmoded Concept," *Environment and Society,* Robert T. Roelofs, Joseph N. Crowley, Donald L. Hardesty, Editors. Englewood Cliffs, New Jersey: Prentice Hall, Inc., 1974, pp. 17-28.

Hare, Kenneth F. "How Should We Treat the Environment," *Science,* 23 January 1970, v. 167, pp. 352-355.

Moncrief, Lewis W. "The Cultural Basis of Our Environmental Crisis," *Science,* 30 October 1970, v. 170, pp. 508-512.

Murdoch, William, and Connell, Joseph. "All About Ecology," *Western Man and Environmental Ethics,* Ian G. Barbour, Editor. Reading, Massachusetts: Addison-Wesley Publishing Company, 1973, pp. 157-170.

Nash, Roderick. *Wilderness and the American Mind.* New Haven: Yale University Press, 1967.

White, Lynn Jr. "The Historical Roots of Our Ecological Crisis," *Science,* 10 March 1967, v. 155, pp. 1203-1207.

Further Reading

Barrett, Gary W., and Puchy, Claire A. "Environmental Science: A New Direction in Environmental Studies," *International Journal of Environmental Studies,* 1977, v. 10, pp. 157-160.

Cairns, John Jr. "Academic Blocks to Assessing Environmental Impacts of Water Supply Alternatives." *The Thames/Potomac Seminars: The Proceedings of the Washington Seminar.* Anne M. Blackburn, Editor. 1979, pp. 77-79.

Marx, Leo. "Pastoral Ideals and City Troubles," *Wetsern Man and Environmental Ethics*, Ian G. Barbour, Editor. Reading, Massachusetts: Addison-Wesley Publishing Company, 1973, pp. 93-115.

Odum, Eugene P. "The Emergence of Ecology as a New Integrative Discipline," *Science*, 25 March 1977, v. 195, pp. 1289-1293.

Sacks, Arthur B. "The Undergraduate Environmental Studies Curriculum: Developments Within a Liberal Studies Tradition," *Current Issues in Environmental Education IV*, Craig B. Davis and Arthur B. Sacks, Editors. Columbus, Ohio: ERIC Clearinghouse for Science, Mathematics, and Environmental Education, December, 1978, pp. 137-140.

Wolman, M. Gordon. "Interdisciplinary Education: A Continuing Experiment," *Science*, 25 November 1977, v. 198, pp. 800-804.

Involving Rural Children in Environment and Development Issues: A Case Study from Kenya

DAVINDER LAMBA and DIANA LEE SMITH*

This paper describes an environmental education project in Kenya which has set up a two-way flow of information between environmental researchers and rural primary school children. With its population of about 15 million mostly living in rural areas, Kenya's environmental problems are also those of development. Between 70-90% of Kenyans use firewood or charcoal as a major source of fuel, and deforestation needs to be slowed down and hopefully halted by tree planting, more efficient use of wood and other measures. Few people, even in towns, have access to piped water, and water is an issue that rural children are daily involved in not only through contributing their labour to carrying it, but also the effects on their health through protection of water at source and in use. Trees are an important source of fuel, building material, food, fodder, medicines and other products, yet they are rapidly disappearing, due to high competition for land, and with them the traditional knowledge about their productivity.

These are just a few examples of environmental problems that affect children as well as the rest of the population. But children and schools are also important resources, for they are often the most literate part of a population, as well as having time and energy to devote to learning about their environment and improving it. In 1979, Mazingira Institute initiated a programme both to reach the schools with environmental education materials and also to mobilize them as sources of environmental information.

The project was started at the invitation of the National Environment Secretariat of Kenya Government, as part of its coordinating role for World Environment Day 1979, which was also the International Year of the Child. Mazingira Institute designed an information package on tree planting, and with a small amount of money from private donations sent out free copies to all primary schools in the country. The Wildlife Clubs of Kenya helped by mobilizing secondary school children to wrap and address the magazines. Rainbow magazine, a local weekly children's magazine which usually only reaches urban children, was used as the vehicle, and provided editorial services and additional material. Together with Rainbow staff, Mazingira put together a special issue with a comic strip "Mingu's Mangoes" about two children successfully planting trees and caring for them, and information about World Environment Day and other organizations involved in tree planting.

---

*Mazingira Institute, Nairobi.

There were aslo the usual magazine features, such as jokes, puzzles and children's letters, all chosen for content dealing with trees and tree planting. In addition, there was a tree essay competition, asking children to identify the uses of trees and shrubs in their area. Out of 6000 schools, 700 responses were received, from individuals on their own initiative or as a result of classroom activity organized by teachers.

Children were asked to name and describe the tree or shrub, its location, and how its various parts are used. Many also described how these parts are processed for use. The best entries came from rural children, some even in remote areas, for the urban children lacked the daily experience of using trees for different purposes and particularly the traditional uses. Rural children put together what they learned of customs and practical knowledge at home with what they learned in science at school. Many took the trouble to talk with the old people at home and learn from them in order to enter the competition.

The United Nations Environment Programme and Beijer Institute of Sweden gave Mazingira enough money to employ two graduate students to go through the entries, choosing the winners and extracting useful information. A lot of effort went into identifying the species, for many children only *knew the vernacular names. In the end, half of the species were only* identified by their local names, but all were listed in a publication called *Uses of Trees and Shrubs Identified by Rural Children in Kenya*, including a map of the fuelwood species identified in each district. What this first competition established was that rural school children are a rich source of data. Though not a random or representative sample, those who entered the competition contributed case study data about 351 species. For example:

> *WARBUGIA ugandensis* has medicinal uses. Its twigs are chewed to cure toothache, while the bark is boiled and mixed with fat to provide a postnatal medicine for women which is also used to relieve labour pains in one district. Elsewhere the bark is ground and mixed with tea to cure chest and stomach pains. The timber is also used for building.

ACACIA mellifera has a fruit eaten by livestock while the trunk is used for building and tool making and the branches for fuel.

However, no resources were available to repeat the experiment of collecting data in 1980, so instead Mazingira organized a drawing competition about water supply. This time the comic strip "Mingu Builds a Water Hole" showed the same two children collecting and storing water for their animals in the dry season. By now there were 7500 schools, and about 1500 children entered the competition. Some of the drawings showed the hydrologic cycle from rainfall to rivers, and collection in dams by hand, to use for irrigation or other kinds of consumption. Some showed how buildings are used as catchments and the type of storage, while others concentrated on ways of transporting water in pipes, or in drums carried on carts, animals or bicyles, or being carried by children and their mothers. One of the most interesting aspects of the drawings was how they should the different ways of collecting and storing water in different climatic zones, from carefully managed animal watering holes in the dry areas to the irrigation systems of the high potential areas.

In 1981 the UN conference on New and Renewable Sources of Energy was held in Kenya, focussing national attention on energy, which in Kenya means woodfuel. Mazingira's children project again returned to the theme of trees, this time concentrating on their use as energy. For the first time it was possible to collect and analyze data more systematically, thanks both to the previous experience gained in collecting responses from children by mail, and to the Canadian International Development Agency which provided funds.

The two children who had appeared as comic-strip characters the previous years were portrayed collecting and carrying firewood, then improving a traditional three-stone fire for better thermal efficiency so that they could ease their burden. More detailed illustrated articles showed a step-by-step procedure for improving the 3-stone wood fire and the typical charcoal-burning stove (jiko). A number of specialists engaged on research for Kenya Government and UN helped in preparing the material, which also included general education material on energy, and two competitions. The Woodfuel Efficiency competition asked children to suggest ways of conserving energy, while the Energy Competition was designed as a questionnaire about sources of fuel, preferred species, types of stoves and cooking utensils, tree-planting and seed propagation and changes in fuel availability. As usual, prizes such as books, T-shirts and subscriptions to the magazine were offered to both individuals and schools.

By this time there were 9600 schools and over 2300 entries were received, mostly to the energy competition, thus providing a larger data base. There is still no doubt that the data is skewed: in some districts there are few entries but in others many, while sometimes nearly everyone in a school or class will enter, but only one or two from another school. Nevertheless, the case value of the material remains, supported by the increased number of instances. It has been possible to preapre tables of firewood and charcoal Species, stove types, utensil types, distance to fuel source and tree planting patterns by district, together with much descriptive material on these and other questions relating to the changing experience of fuel gathering by children and their older relatives.

As learned from other surveys carried out by Mazingira among urban households, many families used more than one source of energy, although in rural areas it is almost always firewood with occasional use of charcoal. Sometimes agricultural wastes such as maize husks are used. Access to a fuel source varied from a few minutes to 3 hours away, with many people having a variety of strategies for obtaining fuel, usually only buying it where it became impossible to get themselves. There was a contrast in attitudes to the enclosure of land, those families had land reporting the opportunity this gave to propagate trees, those without reporting the change from free access to commonly owned land as a hardship in terms of distances travelled and quality and quantity of fuel. There was a surprising numbe[illegible]ildren who reported that they or their parents planted seeds or seedlings, some describing in detail the collection and propagation of seeds.[1]

Schools in Kenya are often the focal points for initiating tree planting activities: they have the land, the constant need for a fuel supply, and the motivation and interest to respond to national campaigns, as well as the resources of time and knowledge. One result of the first Trees Competition in 1979 was that Mazingira started to enquire into the activities of schools who had shown a marked interest in the competition. In 1980, a number of such schools were visited, and out of this grew a proposal for another project: Experimental Agroforestry Plots in Rural Kenya. Several plots in 3 different ecozones (high, medium and low potential) are being assisted, with advice on planting regimes, organization and management, to grow mixed tree and agricultural crops which develop the land potential and provide fuel, fodder, food or building material through trees. In each case, a local organization with land set aside develops its priorities and an organizational structure for running the plot and managing its produce. Half the organizations are schools.

---

[1] The data from the energy competition is still being processed. These comments are based on a preliminary scanning of the raw material.

This project, which began in May this year and will continue at least for another three years is one example of potential extensions of such environmental education activities into applied research and community organization.

It is hoped to continue the Institute's programme in future years in the same integrated way: the dissemination of environmental education materials is linked not only to the two-way exchange of information, but also the exchange of ideas and assistance to environmental management activities. Other possible initiatives are assistance to schools in developing more efficient stoves, biogas plants and so on. In 1982, it is planned to focus the annual special issue of Rainbow on sanitation and health.

One of the major benefits of this type of environmental education project is the capacity to reach a large number of people with very limited resources, that is, through the mail. The rewards are great in that this target group has very little access to similar materials, and is therefore motivated to make best use of them. Many of the schoolchildren have never before seen Rainbow magazine, and many schools have a severe shortage of books. The competition prizes of books and magazine subscriptions are highly sought after, and Mazingira and Rainbow try to spread the rewards as wide as possible, to reinforce the children's participation and contribution of data.

Food or Fuel

DR. MOHAMED KAMEL*

Intorduction

For the first time since agriculture began, the world is faced with a *potentially massive* diversion of agricultural resources to the *production of non-food crops*. Unfortunately, this is beginning to happen at a time when efforts to expand world food output are losing momentum, when *food prices are rising*, and when *malnutrition is increasing*. As the eighties begin, *world oil production is leveling off*. Most energy analysts agree it will not increase much more, if at all. Along with this bleak production prospect, there is a growing uncertainty of supply.

As world *price of oil* climbs continually with no apparent limit in sight, signals a fundamental change in the outleak for liquid fuels. This changing prospect has triggered an intense *international search for alternative liquid fuels*. Prominent among these are liquid coal, oil from tar sands and oil shale, and alcohol that can be *produced from plant shale*.

However, due to lack of experience in the development of liquid fuel from coal or tar, many countries are turning to alcohol distilled from food commodities as a source of fuel for automobiles. Alcohol fuel industry has several attraction; automobile engines can readily burn a gasoline/alcohol mixture containing up to 10 per cent alcohol without any adjustment. The commercial production of alcohol for industrial purposes is already a well-established industry and the technology for converting *plant materials into alcohol is widely dispersed* throughout the world. Lastly distilleries can be built in 6 to 24 months. This combination of advantages has had several countries to launch agriculturally based alcohol fuel programmes. Both *Brazil* and the *United States* have announced major programmes to convert agricultural commodities into alcohol. Several other food-exporting countries—such as *Australia, New Zealand*, and *South Africa*—are actively considering the conversion of crops into alcohol for fuel on a commercial scale. This new iterest in fuel crops could be a historic landmark. If more and more oil refineries are replaced by alcohol distilleries, the agricultural economy will be transformed. With the introduction of fuel crops, the possibility exists for the first time of a major shift of food production capacity to non-food purposes. The increased production of energy crops will intensify pressures on the *earth's cropland—pressures that are already extensive erosion and soil deterioration.*

---

*Chairman, World Youth Congress on Food and Development, CAIRO.

The demand by motorists for fuel from energy crops represents a major new variable in the food/population equation. The stage is set for direct *competition between* the affluent minority, who own the world's *315 million automobiles, and poorest segments of humanity, for whom getting enough food to stay alive* is already a struggle. As the price of gasoline raises, so, too, will the profitability of energy crops. Over time, an expanding agricultural fuel market will mean that more *farmers* will have a choice of producing food for people or fuel for automobiles. They are likely to produce whichever is more *profitable.*

Choosing Food or Fuel

Turning to energy crops as source of automotive fuel opens a new chapter in the history of human efforts to achieve an adequate food supply. The attractions of alcohol fuel are clear, for countries buffeted by soaring oil prices and possible supply disruptions, the prospect of an easily available substitute for some of the imported oil is an inviting one. Although the world's oil reserves are concentrated in a handful of countries, the *potential for producing energy crops is as widely diffused* as agriculture itself.

There are also some solid *environmental reasons to* support alcohol fuel. It is *clean-burning* when used alone and, when mixed with gasoline it can substitute for lead as an octane booster.

In contrast to the burning of petroleum, liquid coal, or other automative fuels of fossil origin, alcohol produced from plant materials *does not increase the amount of carbon dioxide in atmosphere,* unless, of course, it leads to an overall *reduction in the plant materials in the world.*

In addtion, *alcohol is renewable resource,* a potentially important component in any effort to create a sustainable economy. Many programmes have been done in many countries. One of energy crops programmes will be a reassessment of national population policies. As food exporting countries particularly the *United States,* attempt to *increase automative fuel self-sufficiency by converting exportable grain supplies into fuel, food-deficit* countries will be forced to become more self-sufficient. *Moreover, these countries are ni greater dependence on U.S. food exports,* members of Congress from the Mid-Western Corn Belt have been among the most active supporters of gasohol programme.

Distillers have an obvious interest, one that is certain to expand as the number of distilleries increases. For *farmers,* an automative fuel industry based on agricultural commodities has a strong economic appeal. They see alcohol fuel as a way not only of *expanding the market* and boosting the price for their products but also if they distill their own fuel of becoming *energy self-sufficient.* Alcohol fuel has a powerful political appeal to motorists who bear the burden of rising gasoline prices and who feel vulnerable to possible oil supply disruptions. The political influence of automobile owners in countries at intermediate stages of economic development such as Brazil, should not be underestimated.

The people who own cars in these societies are the urban elite who also dominate the political power structure. As governments in the Third World consider diverting crop-land to the production of fuel crops rather than food, those who own automobiles may have a disproportionately large say in the matter. These attractions of agriculturally derived alcohol fuel must be set against its potential impact on world food prices. By far the most serious environmental impact of energy crops will be the additional pressures they put on cropland. At least one-fifth of the world's crop-land is now losing top soil at a rate that is undermining its productivity. With the demand for food projected to double again over the next generation, it will be difficult to lighten the demands on soils and to arrest their long-term deterioration. If in addition vast areas are planted to energy crops, the problem will become even more unmanageable.

In absence of any governmental limitations on the conversion of agricultural commodities into fuel the price of oil could eventually set the price of food; production of energy crops will expand until an economic equilibrium is reached between the prices of agricultural commodities used as distillary feedstock and those used for food or feed.

In the absence of governmental intervention to restrict conversion of foodstuffs into fuel, affluent motorists will be able to bid food resources away from the world's poor. As the price of oil rises so will the profitability of producing agriculturally derived fuel. In the United States, which has 40% of the world's automobiles and which accounts for fully half of all the gasoline consumed in automobiles, the political pressures to produce liquid fuels domestically will be particularly strong. The phased decontrol of oil prices in the United States, scheduled to be completed by October 1981, will raise the domestic price of oil to the world level, whatever it is at that time, by late 1981, when the price of gasoline will almost certainly be above $2 and may be closer to $3 a gallon, the production of automative fuels from agricultural commodities may be highly profitable even without government subsidies on gasohol.

"The problem is not whether there should be an alcoholic fuel industry, but there are many possibilities for converting agricultural wastes and other sources of plant materials into automotive fuels that need to be urgently pursued". Liquid fuel from plants, whether in the form of alcohol or as direct hydrocarbons extracts, is an energy source that needs to be aggressively exploited everywhere.

If the potentially adverse effects of current programme to produce fuel from crops are to be minimised, *several steps must be taken immediately*.

1. Warn food-deficit countries of the potential reduction in exportable food surpluses, so that they can adjust their agricultural and population policies accordingly.
2. An internationally coordinated effort to arrest the excessive erosion of topsoil and reinforces the move towards energy crops.

Without such an initiative, the widespread planting of energy crops will accelerate the deterioration of the world's cropland base.

Within the food-exporting countries, the short-run attractions of converting food surpluses into alcohol fuel are undeniable. In a world that no longer has any excess food production capacity, the decision to channel food stuffs into the production of automotive fuel will inevitably drive food prices upward for the world's affluent, such rises in food prices may lead to belt tightening, but for several millions who are already spending most of their meagre incomes on food, continually rising food prices will further narrow the thin margin of survival. So it is essential for political leaders to assess the world wide impact of national energy crops initiatives on food prices.

Women and Energy

DR. MOHAMED KAMEL*

"There has been a steady stream of non-governmental reports on the vital role of women in the development of new energy sources and their central role in helping communities in developing countries survive the present crisis".

(Women in the 80's—women are vital in energy search. Global Negotitaions—Action Notes—No. 12, May 25, 1981).

If we analyze the above quotation, weigh its importance and try to apply it, or what it implies to the Middle Eastern Region, and particularly to Egypt, we find that it does not apply in terms of a condition for survival, nor as an imminent and present crisis. Women do have a vital role in helping their communities, especially in the rural areas, women could justifiably be called the "backbone" of their immediate and in some cases extended families, as well as within their local community a lot of them are considered and looked upon by their neighbours as what we would refer to as "natural leaders".

(The daya, the mother in law, etc. . . .)

Rural societies, specifically in Egypt, and rural women are two inseparable entities, in the sense that each rural family, basically depends on its female component for their daily survival and the continuity of their stream of life.

Apart from being viewed mainly as childbearers, and specifically of male infants, which is socially, culturally and traditionally considered as one of their vital roles, and an essential condition to their acceptance within their community, adding to their prestige and social status, ensuring the continuity of their married life and husband's respect. Women, specifically in the M.E. in Egypt, in the rural areas, could easily be referred to and described as the "carriers of burdens". They are expected to ensure the survival of their family with "whatever" resources are available. Women have a central role in helping and supporting their communities in the "developing" countries to survive the "present crisis", but it depends on what one can consider a crisis, or even better that the person concerned would consider the "present crisis", namely women. The "present crisis" may be lack of sufficient food, lack of water, poor environmental and health conditions, lack of basic subsistence, food etc. . . and the "crisis" may also be the lack of fuel or energy—so, it really depends on what the specified group of people, this forum has been organized to try and find means and ways to help them better living conditions, it depends on what *they* would define as *their* "present crisis". From here one could start finding, searching for methods to assist and support women in developing countries, unless one views things, situations, and conditions from their standpoint, all the efforts that may be exerted to improve their living conditions, although they would help, would not really be attacking or dealing with what may be considered as the "crux of the problem".

---

*Chairman, World Youth Congress on Food and Development, CAIRO.

The above argument, personal view, does not ignore neither is it trying to lessen the value, importance or necessity of fuel and energy in our everyday lives, but its importance does very from one country to another, depending on its natural resources. Speaking on Egypt's behalf one may reassuringly say that it does not at least for the present time suffer from an energy crisis. As to the rural Egyptian woman, although her main source of fuel; as in many other countries, is basically coal, wood, residues and dung, she still does not put a lot of "importance" to fuel or energy neither does she fear suffering of any shortages. On the other hand, the Egyptian rural women does consider the lack of water, food, proper hygienic conditions, the basic subsistence needs required for the well-being of her family, as her "present crisis".

Egypt is predominantly rural approx. 56 per cent of population is living in rural areas (CAPMAS, General Population and Housing Census, 1976). Most of the rural areas, specifically in Upper Egypt, are lacking natural wealth resources and the major economic activity is agriculture.

In recent years, there has been a decrease in agricultural yields and livestock production. Low incomes and lack of resources in rural areas have fostered outmigration of males to urban areas and to neighbouring Arab countries, further contributing to the decline of communities in rural areas. Women, due to the increasing immigration of men, the traditional supporter, keeper and protector of the family, to other Arab countries basically for financial reasons, the Egyptian rural woman is now also a socially recognized "caretaker" of thier family.

Illiteracy rates run relatively among men and women, if compared with other countries, 56 per cent illiteracy, especially for the female segment of the population, some 71 per cent of the female population are estimated to be illiterate.

Health conditions are also unfavourable, with a high prevalence of bilharziasis, gastroenteritis, bronchitic and epidemic diseases. The majority of those diseases are linked either directly or indirectly to the existence of poor environmental health conditions. In fact, lack of sufficient potable water and proper sanitation facilities constitute one of the foremost problems in rural Egypt, (it is estimated that roughly one-half of all infant deaths in rural areas may be ultimately attributed to the above factors. Approx. 152 infant deaths per 1000).

The percentage of rural inhabitants lacking access to safe water supply is estimated to be in the vicinity of 36 per cent on the nationtal level with many satellite villages totally lacking proper water and sanitation facilities.

Cultural factors further compound the situation, such as strongly entrenched traditional beliefs and practices and cultural diversity, some areas are noted for high male-status orientation and numerous restrictions imposed upon women, to ensure the maintenance and continuity of large family norms.

All the above factors should be taken into consideration, in one way or and her, especially if we are exerting efforts to help and assist local communities, whether in the field of energy sufficiency or any other field, they need to be taken into full consideration if plans, development programmes, or strategies are to be drawn out in a relevant way to the existing local communities.

There are also social and economic factors that affect the implementation of any development plan and should be taken into consideration, for example, there are numerous restrictions that govern the daily life of women and many remain in seclusion. The role of women is still viewed as exclusively that of wife and mother (especially of male children) and consequently, expectations are imposed accordingly and priorities drawn out. In addition, income factors also affect the daily life of individuals, the family's meagre income is needed to cover daily food requirements and there is seldom little, if any, left over to pay health or educational expenses.

Taking in consideration all the above factors which are part and parcel of the Egyptian community, and many other "developing countries", specifically in the Middle East, the final question addressed to this audience—"Where is the vitality of women's role in the search for energy," or let's say 'Should energy be described as a "present crisis" to be dealt with to ensure the development and welfare of our nations and people, specifically woman?'

Analysis and Evaluation of Environmental Education in Southeast Asia

DESH BANDHU*

The seventies of the twentieth century will be known in the history of man the decade of environmental revolution. The seventies started with the beginning of MAF programme of UNESCO, witnessed the United Nations conference on Human Environment (Stockolm 1972), Human Settlements (Vancouver 1976), Water (Mar del Plata 1977) Desertification (Nairobi 1977), UNEP-UNESCO conference on Environmental Education (Tibilisi 1977), and the conference on Science and Technology (Vienna 1979). The question why environmental education has been discussed more than enough and the governments as well as individuals realize well the importance and need for Environmental Education.

The purpose of this paper is to analyse and evaluate the Environmental Education activities in South-East Asian countries. The paper describes the activities and organisations involved, and to determine problems and contraints facing the development of Environmental Education programmes in 10 South-East Asian countries (Annexe I). The Environmental Education interest in recent years from both intra-curricular and extra-curricular point of view, through comparatively new, has been extremly keen and gathering momentum both within school and outside during recent years.

The Environmental Education programmes in these counties are based on the following goals:

—to improve the quality of life;

—to create an awareness among the people to environmental problems and conservation;

—to help citizens to acquire the necessary knowledge to the necessary attitude for environmental protection;

---

*Department of Landscape Architecture, School of Planning and Architecture, New Delhi,

—to develop the necessary skills to solve the environmental problems;

– to create an ability in people to evaluate the different strategies for development in terms of social, political, cultural and educational point of view;

—to create the necessary atmosphere to make it possible for the citizens to participate in decision making when it concerns the environment;

—to provide an awareness of the economic, political and ecological interdendance.

The educational system in many Asian countries has been traditionally geared to the production of an elite which parallels the trickle down models of development that are questioned in many countries of the region. Education has resulted for the mass of the population in a sense of failure and alienation from learning and successful few, in an isolation from the life styles of the bulk of the population.

There is a great deal of Environmental Educational activities in Asian region. Some of the activities are under formal title of Environmental Education. The present pattern is so varied that no generalization can be made about the Asian region as a whole. Nevertheless there are many programmes of great interest and it is the purpose to present a number of examples.

Formal Environmental Education

Courses and curriculum dealing with environmental topics are being designed and incorporated into teaching programmes in a number of schools, universities, educational and academic institutions throughout the region. In addition considerable research work in this field is now underway at academic institutions and research laboratories.

Recently in 1976, Bangla Desh introduced a programme of education known as 'Nuktangan Sikhha'. The curriculum of this programme is chosen to suit the experience and interest of pupils from a wide range of areas which include village environment, the production, marketing and distribution of crops and other environmental issues. In addition to this programme environmental education is introduced in primary schools as a new subject. The National Council of Educational and Training in India, set up by the Ministry of Education, has developed curricula and text books which are being used in schools throughout the country. In Hong Kong, the environmental kit produced by the Ministry of Education is used by school students as a part of their school education. In Philippines, Malaysia and in Indonesia the Environmental Education at schools level is given importance. In Nepal, the Environmental Education increasing. The school programmes include topics which are related to the forestry and at the protection and appreciation of cultural monuments. In Sri Lanka and Indonesia the population is given importance. In Sri Lanka there is strong recognisation of the importance of the primary and lower level education since 80% of the population terminates their formal education at school level. Similar is the case in India, Nepal and Bangla Desh. In some countries the science kits or environment kits are developed which are used as the educational material. Other education aids are being developed.

Environmental Education at University Level

Ecology is being taught in most of the universities in the region at undergraduate/graduate level. The school of Biological Sciences at the University of Malaya, Banares Hindu University, University of Ceylon, Institute of Ecology Pajajaran, University in Indonesia, the Chinese University of Hong Kong are some of the institutes which have developed programmes in Ecological and multidisciplinary training in natural sciences. The ecology is becoming a more prominent field of scientific inquiry and education. This is related to the trends towards problem-oriented team research among faculty. In recent years ecologists, geographers, anthropologists and biologists have begun joint research projects and seminars. The post-graduate diploma in Resources Ecology started by Banares Hindu University in India is the example of this multidisciplinary approach.

In some universities, the Ecology is taught as the special paper at Master's and Graduate level. In recent time several Environmental Biology Departments have started in Indian universities. These departments offer courses in biology, ecology, conservation, soil sciences and orient towards environmental sciences. Similar courses are offered in Nepal and Bangla Desh, although in these countries they are not termed as environmental biology.

Some of the universities offer courses as Environmental Science. The faculty of Science and Environmental Studies, University Pertanian, Malaysia, Mahidol University in Thailand, Jawaharlal Nehru University in India, the Institute of Environmental Research, Chulalalongkorn University, Bangkok University, the Philippines at Diliman, and some

Institutes of Engineering offer courses in Environmental Sciences at Master's and Doctoral level.

Environmental Education and Professional Courses

The Environmental problems constitutes a part in some of the professional courses, much as public health engineering. The Institutes of Technologies and Engineering Colleges in India and throughout the region provides courses for Bachelor of Engineering. In India, the National Environmental Engineering and Research Institute (NEERI) provides opportunities for research in Environmental Engineering Sciences.

The University of the Philippines at Los Banos, the Bogor Agricultural Institute (Indonesia), the Malaysian Agricultural University, Indian Council of Research Institute, Kasetsart University (Thailand), Marga Institute (Sri Lanka), Forest Research Institute (India), are the centers of academic expertise in agriculture, forestry, fisheries, agricultural engineering and rural development activities. They are oriented towards providing the mid-level managerial training programmes to the public and private sectors and towards improvement in rural welfare. The courses offered at these universities are microbial ecology, geomorphology, air water soil and solid waste pollution, limology, forest ecology, and environmental protection engineering.

Courses leading to M.D in community health administration is offered by a number of medical schools in these countries. The other courses offered are Public Health, demiology, communicable and non-communicable diseases, Ecology of the human diseases and man and his environment. The All India Institute of Medical Sciences, Faculty of Tropical Medicine, Mahidol University, the Instutute of Human Ecology in Philippines are some of the institutes which offer these courses alongwith a number of medical schools in these countries.

Environmental Education and Resource Planning

Programmes of the National Agricultural Universities in South-East Asia countries are giving primary attention to the needs of resources management agencies.

The Environmental Education Research Project in Mahidol University in Thailand started in 1974, aim to strengt[illegible] activities environmental and industrial control, urban and resource planning and policy analysis. The project organize a number of seminars, conferences, courses and bring out a number of publications for the extension of ideas and techniques.

The other institutes in the region carrying similar activities are Asian Institute of Technology, University of Philippines, Development Academy of Philippines, Asian Development Institute, Indian Institute of Public Administration in New Delhi, Kuala Lumpur and Manilla and various Institutes of Management Studies in different countries offer similar activities. Most of the institutes use case studies as the part of their curriculum. The Women's University of Philippines, the Institute of Environmental Society offer short term programmes for planners. Similar courses and activities are under planning in number of other institutes in the region.

Population and Environmental Education

In these countries the population is considered one of the root of the environmental problems. Thus, the population education is given due importance in Environmental Education activities in these countries. A number of Institutions and Foundations are active in developing courses and instructions in population education. Indian Institute of Economic Growth (New Delhi), National Family Planning Board (Jakarta), Federation of Family Planning Association (Kuala Lumpur), Institute of Maternal and Child Health (Quezen City, Philippines), Institute for Population and Social Research, Mahidol University and Asian Institute for Economic Development and Planning (Bangkok) are some of the institutes which provide training on population education and orient the activities with environmental planning, human settlements, social and economic structures of the society. The material used by these institutes is mainly research publications, news bulletins, films and field demonstrations.

Education in Environmental Sciences

Multidisciplinary training in natural sciences is becoming common in the region. The publication of Newsletters and journals on Ecology and Environmental Sciences are becoming more common in the region. The 'Wallaceana' which is published by the School of Biological Sciences, University of Malaya, include informations on research, meetings and publications in Tropical Ecology. The International Society for Tropical Ecology publishes a journal which include research and review articles. The Institute of Tropical Biology (RIOTROP) publishes regular publications and reports on Tropical Biology and various aspects of ecology. The International Journal of Environmental Sciences published from University of Rajasthan, include research and review articles on various disciplines on environmental sciences. The Development Academy of Philippines, The Agricultural Development Council (Bangkok) has published a number of reports and documents on the current situations of environmental activities in these countries.

Environmental Research and Legislation

The integrated research project on forestry, natural resources and development has been undertaken by Ministry of Forestry in Nepal. The programme aims to go on watershed management.

Similar activities are undergoing in Sri Lanka (Mahaweli Development Project) and Bangla Desh. The most of the countries in this region have set up National MAP Committees to promote and to support research activities on Environmental Conservation and Protection. A number of research projects in different universities are in progress and a number of students are working for their doctoral degrees. The listing of these projects and their details will not be possible in this presentation.

In the region, there are some examples of countries where environmental legislation concerning various aspects of the environment, e.g. population, water pollution, air pollution, and air quality, conservation of natural resources, wildlife protection and conservation of monuments and cultural heritage, etc. Some of these legislations have also included reference to general environmental education for the community. However, the experience of educational programmes in these countries is that the participation of the people and the recognisation at the ministerial and higher levels is more important in implementing the Environmental Education programmes.

Non-formal Environmental Education

Environmental organisations are established in nearly all the countries although their membership is relatively small and fortunately environmental education is beginning to reach a larger section of community, through the programmes of several youth and other environmental activities and a few governmental departments.

The main type of organisations provising out-of-school environmental education are:

—Self-governing environmental organisations.

—University students environmental associations.

—Natural history societies, wildlife and school clubs.

—Consumers associations, community groups, environmental action groups.

—Non-specialist organisations such as scouts, pioneers, youth farmers religious and political youth groups, civic trusts.

Self Governing Environmental Organisations

In the region there are number of environmental organisations. The examples are Indian Environmental Society, Environmental Protection Society of Malaysia, Sri Lanka Environment Society, Society for Conservation of Nature & Environment Bangla Desh, Hong Kong Conservancy Association, and INDHRRA (group of ten organisations in Indonesia). There are other number of organisations which are active on Environmental Education. The activities of these organisations include organisation of study camps and seminars on different problems of Environment. The activities also include production of educational material such as publications, slides, charts and demonstrations. COSTED has produced a series of slides on environmental problems which are available to Environmental organisations for use in their activities. The Indian Environmental Society has printed a number of reports and results of various seminars organised on various problems. The Environmental Protection Society of Malaysis has printed publications on Solar Energy. The activities of the organisations are directed to various groups of the community including planners and decision makers.

University Students Environmental Associations

A number of activities are carried by the university students organisations in these countries on environmental education. The Ecological groups in various universities such as University of Malaya, World University Services in Sri Lanka and Hong Kong group of students at the University of Philippines, Chinese University of Hong Kong are some of the examples. The activities of these groups include discussions, seminars and lectures by experts. These groups also use films which they loan from United Nations Information Centers and US Communication Agencies in their respective countries. Some of the groups celebrate World Environment Day.

Natural History Societies, Wildlife and School Clubs

The Natural History Societies and Wildlife Clubs in association with WWF and IUCN organise a number of activities on Environmental Education. These include the field trips, film shows and printing of stickers. The activities are aimed to make community aware of the problems on Wildlife protection.

Consumers Associations, Community Groups, Environmental Action Groups

The Consumers Association of Penang (CAP) and consumers associations in India, Singapore, Thailand are very active on Environmental Education. The Consumers Association of Penang has established Environmental Research Division. CAP also publishes a News paper which highlight the Environmental problems. The Anti Sand Extraction Committee in Goa, Bombay Bachao Committee, Chipko Movement in Himalayan region, Youth Action group in Hong Kong, Bangla Desh Volunteer Service, Lanka Jatika, Sarvodaya Shramadana Sangamaya in Sri Lanka, Ecological Society of Thailand, Urban Designers Association in Philippines, are some of the active community and action groups. The activities of these groups include drawing the attention of people and authorities on the environmental problems. Their activities also include demonstrations and hunger strikes such as by the volunteers of Chipko movement.

Non Specialist Organisations

A number of oganisations such as the Chamber of Commerce in Singapore, Hong Kong Chinese Chamber of Commerce, Earth Day Observance and Planetary Citizen's Council in Singapore (EDC/PC Council), 4-H clubs in Indonesia, are also having activities on environmental education. In Singapore, the Environmental Education for young people is carried on through science-fiction stories (EDO/PC Council). Some organisations such as Asian Youth Council are also having programmes to educate people in these countries.

The non-formal environmenal education activities are carried through press and mass media also. The press institutes and the institutes of Communication and Mass Media, are having programmes to educate journalists and reporters on Enviornmental problems. In some of the countries such as India, Nepal, Sri Lanka, Malaysia, Singapore have regular programmes on radio which are directed towards Environmental Education. The television also play important role in some of these countries.

Regional Environmental Organisations

At present there are not many Regional Environmental Organisations. The Asian Environmental Society which has been working in many countries of the region has started some activities on Environmental Education.

Problems and Possible Solutions

Apparently, environmental education has made its mark but all is not well in deeper analysis. The number of students offering these courses at various levels is too small. The most important factor responsible for the poor response is that students trained in multidisciplinary courses experience great difficulties in finding suitable jobs. The course contents are also far from adequate; another important aspect is the education of the teachers themselves, most of whom had no or little training in environmental sciences in an integrated manner. At the primary and secondary level in some countries, the courses have been completely overhauled but there has been no reorientation of the teachers.

Some of the problems faced in these countries are below:

—deficincy of Environmental Eductation knowledge among enforcing authorities

—lack of responsibilities due to the ecological illiteracy on part of community

—lack of provision for the training of professional manpower in the field of environmental education

—non-availability of informations on environmental issues

—lack of coordination among the administrative institutions and educational institutions on environmental activities.

The Environmental Education is considered a subject for science students and no relevance to those offering social sciences and humanities. Thus, there is a great need for re-orientation courses for teachers, educators.

However still more important than the formal education in Asian countries is the non-formal education, i.e., the education for general public, planners and administrators. Unless the public in general and the decision makers and planners become aware of the problems and consequences of their actions little success would be achieved in attain-ing the ultimate goal of environmental education—the improvement of the quality of life. Here the people are not to be educated about the complex scientific principles of ecosystems or environmental sciences but are to be made conscious of the holistic environment wherein all their actions are likely to influence their life. The media and the press has to play an important role and has to be oriented towards it.

The questions who and how of environmental education need serious thought. Environmental education need not necessary become one more subject on the curriculum. Environmental approach to the existing subjects or in other words, the integration of environment with the ongoing curriculla is desired.

The Environmental education is a big task which require pooling together of all resources and skills. All target groups have to be approached simultaneously otherwise the goal may never be achieved. We cannot wait for environmental education to begin when the environment has become degraded to a point beyond repair.

Annexure--I

1. Bangla Desh
2. Hong Kong
3. India
4. Indonesia
5. Malaysia
6. Nepal
7. Philippines
8. Singapore
9. Sri Lanka
10. Thailand

Environmental Education at the School Level

EMERGING TRENDS IN ENVIRONMENTAL EDUCATION

B. SHARAN*

Environmental Awareness in the Pre-Vedic and Vedic Periods

The environmental controls our life. Earliest records that can be traced tell that in India, this was realised even by the pre-Vedic man, who identified at least four major components, *Mitra*—the Sun, *Agni*—the Fire, *Prithvi*—the Earth and *Dyu*—Sky that sustained life and therefore, worshipped them as deities. As the culture advanced to the Vedic age, Vedic man, expressed importance of environment by singing hymns in praise. For example, *Rig Veda* I-48-5 described: *Ushas* or the Dawn "Like a noble lady *Ushas* comes tending everything carefully. Rousing all life she stirrs every footed creature and makes the birds fly". The english word 'ushers' this prehaps derived from *Ushas*[1].

With the passage of time man realised that environmental resources were necessary both for his survival as well as for better living, so they were used more and more. The indiscriminate use of the environment led to serious ecological imbalances. For example, cutting down of forests led to expansion of deserts, extinction of many species of flora and fauna and floods.

The modern industrialisation has brought new evils. The release of smoke and gases from chimneys has polluted the atmosphere by increasing in it the percentage of carbon-monoxide and sulphur dioxide. The disposal of untreated industrial waste and city garbage into oceans has threatened marine life. The effects in many cases are not local, but global. The weather in country say for example, in Pakistan or Bangladesh may effect the weather of a neighbouring country like India. Another example can be that of a nuclear explosions that occurring in one part of the world may threaten the life all over. So there is a global need for measures for conservation and pollution free environment for sustainance of life and healthy living.

---

*Department of Education in Science and Mathematics, National Council of Educational Research and Training, Sri Aurobindo Marg, New Delhi-110016

Emergence of EE as a Distinct Entity

It was only during 70s that it was realised that no environmental measure could be effective unless it is backed by a mass Environmental Education programme. The seventies in this context may be rightly called the decade of enviromental education (EE) when it emerged as a distinct entity. In support of this, one could cite, the enactment of United States EE Act (1970), first report of the Royal Commission, U.K. on Environmental Pollution (1971), and similar efforts of Sweden, Japan, etc.

The United States conference on the Human Environment held at Stockholm in June 1972 was a major event in the direction of EE. Addressing the plenary session of the conference on June 14, the Indian Prime Minister, Mrs. Indira Gandhi said ".........one cannot be truly human and civilised unless one looks upon not only all fellowmen, but all nations with eyes of a friend". The modern man.........must again learn to recognise as the ancients in India, centuries ago that one can take from the earth and atmosphere only so much as one puts back into them. In their hymn to earth, sages of the *Atharva Veda* chanted: I quote 'what of thee I dig out let that quickly grow over, let me not hit thy vital organs or thy heart'. The Stockholm conference was the beginning of the dissemination of the ideas on Environment through the conference newsletter CONNECT was later followed by the Belgrade International Workshop (1976) and then by Tibilisi Conference (1977), the latter resulting in a document called "Tibilisi Declaration".

Since Tibilisi Declaration 1977, 24 selected pilot projects representing different regions of the world were launched by UNESCO to deal with different aspects of Environmental Education. In addition, during 1978-80, regional workshop were also organised in different parts of the globe.

Guiding Principles

The Tibilisi Declaration provides comprehensive guidelines and certain criteria that help to guide efforts to develop EE at different levels. The word Environment is here used in its 'holistic' nature as the one composed of natural as well as human resources and not merely as one comprising of physical and natural resources only. The environmental situations could include areas like rational use of natural resources, pollution, specific problems of the city, nutrition and health, natural calamities, etc.

What is Environmental Education?

It is very necessary to define EE. No single universally acceptable definition seems to have emerged as yet. One can quote atleast 4 definitions as examples from:

(i) IUCN Commission of Education, 1970.

(ii) Finnish National Commission for UNESCO, 1974.

(iii) National Anti-Pollution Law, Japan, 1969.

(iv) Report of a conference of African Educators, Nairobi, 1968.[2]

According to the IUCN Commission of Education, 1970 "Environmental education is the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the inter-relatedness among man, his culture and his biophysical surroundings. Environmental education also entails practice in decision-making and self-formulation of a code of behaviour about issues concerning environmental quality."

According to the Finnish National Commission for UNESCO 1974 "Environmental education is a way of implementing the goals of environmental protection. Environmental education is not a separate branch of science or subject or study. It should be carried out according to the principle of life-long integral education".

According to the National Anti-Pollution Law, Japan 1969 "EE is to enable people to enjoy good health and a high quality of life. It is vital by preventing harmful effects to human health or damage to the environment caused by pollution of air, water and soil; noise, vibration, noxious smells, etc., caused by firms and individuals. The environment here includes animals and plants and their ecological systems which are closely bound to the livelihood of people.

Acording to the report of a conference of African Educators Nairobi, 1968 "EE is to create an awareness and an understanding of the evolving social and physical environment as a whole, its natural, man-made, cultural, spiritual resources, together with the rational use and conservation of these resources for development".

A close examination of these definitions shows that there is a considerable amount of agreement regarding the general nature of EE.

Pattern of EE Curriculum

The curriculum requires identification of goals, their organisation in different levels, choice of content and methodology to achieve them.

The goals of environmental education as identified in Tibilisi Declaration are:

—to foster clear awareness of and concern about economic, social, political and ecological inter-dependence in urban and rural areas;

—to provide every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment;

—to create new patterns of behaviour of individuals, groups and society as a whole towards the environment.[3]

The goals are organised into four levels:

Level I or knowledge level—focusses on 'ecological concepts', it provides receivers with knowledge that helps in making sound environmental decisions.

Level II—focusses on man's cultural activities (religious, economic, political, social, etc.) that influence the environment or ecological balance.

Level III—focusses on skills that are needed for *issue investigation, evaluation, and values clarification.*

Level IV—focusses on *training and application skills* necessary for citizenship action (participation).

Figure I represents a conceptual model of a curriculum based on the *goal levels* discussed above. This model illustrates a conceptual scheme how the *scope* (operationalised from goal level) can be integrated through grade levels (vertical organisation) and across appropriate disciplines (horizontal organisation). The *scope* (or breadth) defines the extent of coverage by the curriculum in terms of objectives (cognitive, affective and psychometer) or statements of ideas or conceptual schemes.

The *sequence* assigns these elements to grade levels based on a hierarchy of concepts, skills and attitudes (UNESCO Discussion Guide, 1980)[1].

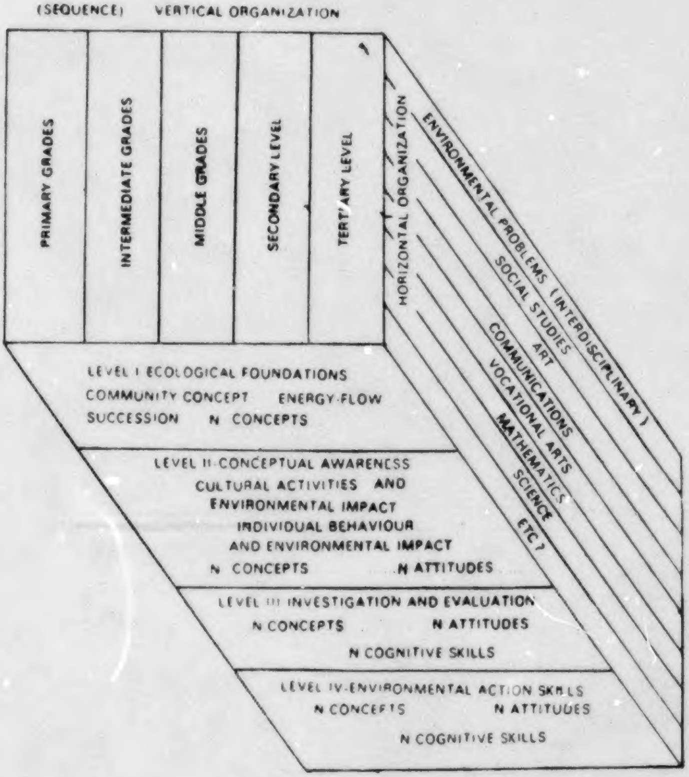

(SEQUENCE) VERTICAL ORGANIZATION
PRIMARY GRADES
INTERMEDIATE GRADES
MIDDLE GRADES
SECONDARY LEVEL
TERTIARY LEVEL
HORIZONTAL ORGANIZATION
ENVIRONMENTAL PROBLEMS (INTERDISCIPLINARY)
SOCIAL STUDIES
ART
COMMUNICATIONS
VOCATIONAL ARTS
MATHEMATICS
SCIENCE
ETC ?
LEVEL I ECOLOGICAL FOUNDATIONS
COMMUNITY CONCEPT ENERGY FLOW
SUCCESSION N CONCEPTS
LEVEL II CONCEPTUAL AWARENESS
CULTURAL ACTIVITIES AND
ENVIRONMENTAL IMPACT
INDIVIDUAL BEHAVIOUR
AND ENVIRONMENTAL IMPACT
N CONCEPTS N ATTITUDES
LEVEL III INVESTIGATION AND EVALUATION
N CONCEPTS N ATTITUDES
N COGNITIVE SKILLS
LEVEL IV-ENVIRONMENTAL ACTION SKILLS
N CONCEPTS N ATTITUDES
N COGNITIVE SKILLS

Figure 1—A conceptual model of the scope and sequence of the EE curriculum

SOURCE: Unesco, Strategies for Developing an Environmental Education Curriculum, Paris, Unesco (ED—80/WS/134) 1980.

The content of EE can deal with substantative socio-cultural or environmental problems which torment man in numerous parts of the world. For example, problem may be relating to public health in the community or village which may include areas such as malnutrition, crop production, food preservation, sewage disposal, deforesutation, etc.

The Discussion Guide for UNESCO Training Workshop on EE (1980) has provided two approaches or models, (i) *inter-disciplinary or infused model* and (ii) *multidisciplinary or infusion model.*

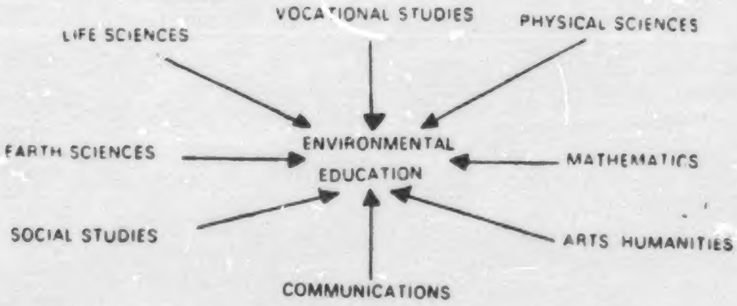
Figure 2-A represents the conceptual model in which relevant components of many disciplines are selected, presented, dwelt upon to create a distinct EE unit, course or module. *Figure 2-B* illustrates the infusion or integration of established disciplines where appropriate. The infusion or multidisciplinary model allows students to apply EE concepts and problem solving skills in various situations over an extended period of time. Many of the concepts and mental processes which are expected outcome of EE, have been traditionally taught separately in other disciplines. For example, students learn about government decision-making in social studies classes, but inspite of *acquisition* of such knowledge they fail to *transfer* the knowledge in their daily life as citizens in environmental problem solving. The reason being, proper teaching for transfer was lacking in the situation. A properly designed EE will take care of such a situation.

According to Reidel, Director, Environmental Programme, University of Vermont, a viable practical theory of EE has to be truly interdisciplinary, blending scholarship and experience in a new educational process. It is a theory of education which recognizes value clarification through *self-awareness*, knowledge through *environmental awareness* and synthesis through *life experiences* as essential components of *Environmental Education*. EE has to be synonymous with 'education' in philosophy and practice[5].

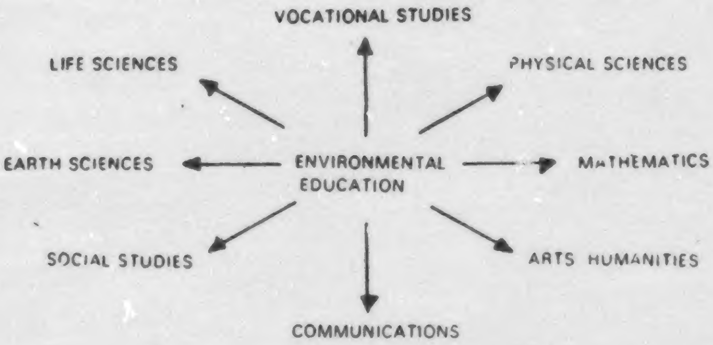
EE in the Indian Context

India has a long tradition of using environment as the basis of learning. For example, our Father of the Nation, late Mahatma Gandhi in his Basic Education Programme laid stress on the need for (i) productive activity in education, (2) correlation of the curriculum with the productive activity and the physical and social environment, and (3) intimate contact between the school and the local community. The report of the Education Commission (1964-66) incorporates the best that Basic Education has to offer and lays emphasis on the 'internal transformation' of education so as to relate it to the life, needs and aspirations of the nation[6]. The principles have been used in framing various curriculum documents, namely "Curriculum for the Ten-Year School: A Framework 1975"[7], Report of the Review Committee (1977) etc[8].

In implementing EE recommendations, there are two serious problems (i) how to reduce the number of subjects in order to reduce the load and (ii) how to teach science in absence of a *laboratory of a kit?* At the primary stage, one suggested solution is to have Environmental Studies where science is combined with social studies and environment


VOCATIONAL STUDIES
LIFE SCIENCES
PHYSICAL SCIENCES
EARTH SCIENCES
ENVIRONMENTAL EDUCATION
MATHEMATICS
SOCIAL STUDIES
ARTS HUMANITIES
COMMUNICATIONS

(A) INTERDISCIPLINARY (INFUSED) MODEL


VOCATIONAL STUDIES
LIFE SCIENCES
PHYSICAL SCIENCES
EARTH SCIENCES
ENVIRONMENTAL EDUCATION
MATHEMATICS
SOCIAL STUDIES
ARTS HUMANITIES
COMMUNICATIONS

(B) MULTIDISCIPLINARY (INFUSION) MODEL

Figure 2—Conceptual models of the EE curriculum

[Source : Unesco, *Strategies for Developing an Environmental Education Curriculum*, Paris, Unesco (ED—80/WS/134) 1980] forms the laboratory for the acquisition of scientific knowledge through the processes of science. The fusion of science with social sciences is defying solution, one has to work more on it. At the middle and the secondary stage, elements of EE are being introduced through infusion model. A serious question is being raised for it to be successful: Will this lead to the development of application and action (participation) skills?

Curriculum for EE in Non-formal Education

The universalisation of elementary education is a national commitment. In India, there is a large number of out-of-school children in the age-group 6-14. A majority of them are girls doing baby sitting and those who are wage earners and supplementing the incomes of their parents. The EE for such children should be part-time self-paced, work and activity based, centred around real life situations and taught through problem solving approach. The learning materials, thus have to be in the form of self-contained and independent learning units which are multi-disciplinary in structure and content so as to cater more effectively for differences in learners' abilities, preferences and interests as well as catering for local conditions.

In India as well as other developing countries, a major problem for which different solutions are being sought and tried out at different levels is the education of out-of-school children including the drop-outs as well as those who were never enrolled in formal schools. It has been observed that though the proportion of *out-of-school* children in the *age-group 6-14* has declined, the number of out-of-school children has been increasing in most of the developing countries, partly because of the rapid growth of population. The concern for education of out-of-school children has resulted in the emergence of a series of attempts aimed at developing various alternative approaches to the existing formal system of education.

The curriculum development for non-formal education is determined to a great extent by the characteristics of the learners. Out-of-school children can be broadly categorised into three groups. These are (1) children, particularly girls, who remain at home to *look after their younger sisters or brothers*; (2) children who help their parents in their economic activities; and (3) children employed as *wage earners*. Therefore, most of the curricula are planned to reach diverse groups of children and to be a basis for a *happy, healthy and productive life* wherever they live. As a result, non-formal education is generally characterised by:

- Provision of education on a *part-time* basis according to the convenience of the learners with flexibility regarding attendance and the educational programmes so designed as to enable the learners to progress at their *own pace.*
- Openness in curriculum: Since children are engaged in work, the *curriculum is work-based, problem-centred and activity based.*
- Openness is methodology of instruction suited to the learning styles of learners: There is *individualisation of objectives, content, teaching methods and evaluation techniques.*
- Openness of evaluation, children can get their performance on a learning task evaluated *according to their willingness and convenience.*
- Organisation of instruction around *real life problems which require inter-disciplinary learning.*

The curricula are, therefore, suggested to be decentralised and flexible, their structure, content and methodologies, are required to have a close relationship to the learners living environment. Taking this into consideration and on the basis of the past experience, a workable *competency model* with Environment Oriented Need Based Approach has been proposed.

The community and many other agencies such as home, school, social and R.D. institutions can also play a major role in the spread of EE in a non-formal manner.

Whether it is possible to link the non-formal system with the formal system remains a major problem.

Implications of EE

The EE has implications in curriculum development, on the preparation of instructional materials, teaching aids and audio-visual materials, use of mass media, evaluation of teaching learning strategies and teacher education. Several questions arise in each of these areas.

It is not possible to prescribe a uniform curriculum for all levels and all schools in the country. The curriculum at best can focus attention on major international, national and regional environmental issues. The problems, such as, who will write textual materials, who will write textbooks, will teachers have sufficient competence to do justice in absence of books, how students would study need solution. One solution may be to provide a curriculum guide besed on competencies desired to be developed in learners. The teaching aids or related audio-visual materials will have to be local specific again. The problems which they pose are, who will prepare them, will they be cost effective?

The Role of Mass Media in Environmental Education

The mass media can play a very important role in the spread of EE. Here it is necessary to take the multi-media approach, since communication may not reach all the schools through one form of medium. While some schools may be able to show films, the others may be able to deal with the subject through slides or films-strips and yet others may only have printed folios containing write-ups and set-up pictures. The communication technology of satellite brings to us the possibility of reaching every nook and corner of the country with radio and television programmes in different languages and meant for different kinds of audience. In India, INSAT Satellite is expected to be available for television and radio broadcast from April 1982 onwards. There are nearly 10,000 cinema houses in the country in which a documentary is shown for a period of 10 to 20 minutes. If one assumes that a documentary is viewed by nearly 300 to 400 people in each show and that there are four shows a day, then in a week, more than a hundred million people (400x4x7x10,000=11,20,00,000) should be able to see a documentary.

Thus, films become an important medium in environmental education.

To disseminate the concepts and concerns of EE, special audio-visual materials should be prepared for use.

EE and Evaluation

Any evaluation has to take care of the nature and structure of the discipline. Uniqueness of the environmental education lies in its six characteristics: (i) inter-disciplinary content of education, (ii) formal as well as non-formal context, (iii) problem focussed approach, (iv) community oriented methodologies or strategies, (v) value clarifying role and (vi) long-term outcomes.

The central problem in evaluation is the measurement of learning outcomes. First step in this direction is that objectives be specified in measurable terms. For an inter-disciplinary topic, the evaluation material has to be in the form of integrative questions, learning here will not be classified as physics, chemistry, biology or geography. In the non-formal context, the content selected for evaluation will have to be either culture free, or predominantly culture biased depending upon whether we wish to compare by the same yardstick students from different regions or the same region. Problem focussed approach must aim at testing problem solving abilities that judge steps that are involved in problem solving. Since EE is community oriented, opinion of observer participants must be sought.

The strategy or methodology of teaching EE depends on both content and objectives of EE. They could be active or passive, descriptive or analytical, informational and experimental, teacher dominated or student oriented, emphasising survey or indepth coverage, experimental or simple expository, etc. The evaluation efforts are to be validated against the expected outcomes of the methodologies adopted for teaching.

The value clarifying role calls for inculcation, appraisal of awareness, sensitivity to environment, commitment and preference for desirable values and receptivity to human feelings.

For diagnosing the inadequacies of the methodologies or the strategies and as well as evaluating the long-term outcomes a continuous evaluation is required.

Any model of evaluation must take into account its key ideas or foci. Being inter-disciplinary in its concept the model must be an integrative model in which pupils' learning outcomes could be visualised as an integral part of curriculum development process as well as in terms of a programme or project intentions. Attempt is made here to synthesise pupil evaluation, curriculum evaluation and programme evaluation to show their inter-dependence, in the integrative model presented hereinafter by means of a figure (Figure 3).

Teacher Education for EE

It is obvious that the teaching of environmental education in schools has implications both for pre-service and in-service teacher education. Teacher training institutions should develop, knowledge, skills, values and commitments of teachers and a chance in their teaching techniques by making optimum use of environmental resources.

Any teacher preparation should include:

(a) basic training in ecology;

(b) field and/or laboratory experiences for teachers in the area of environmental science;

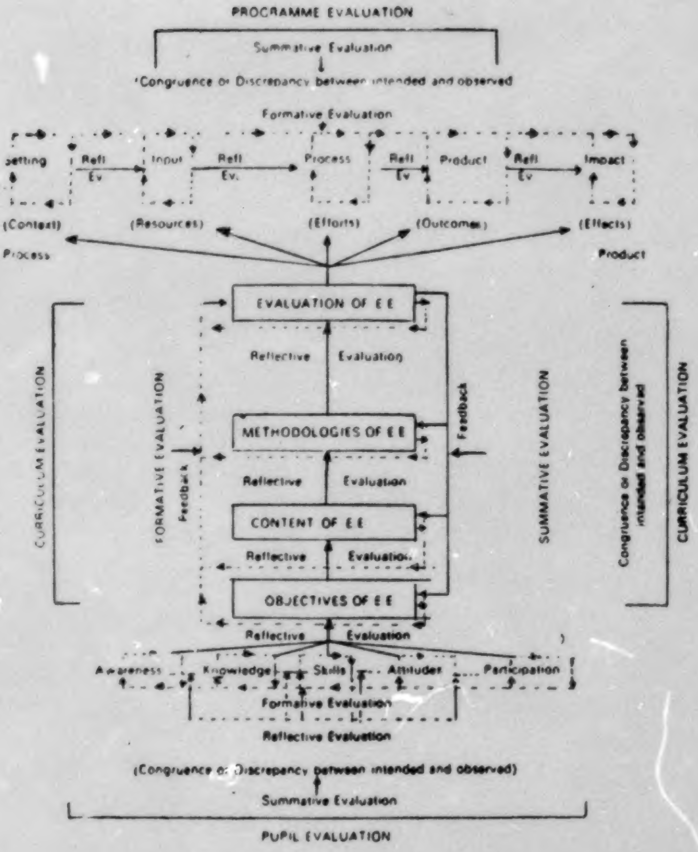

PROGRAMME EVALUATION
Summative Evaluation
(Congruence or Discrepancy between intended and observed)
Formative Evaluation
Setting
Refl Ev
Input
Refl Ev
Process
Refl Ev
Product
Refl Ev
Impact
(Context)
(Resources)
(Efforts)
(Outcomes)
(Effects)
Process
Product
EVALUATION OF E E
Reflective Evaluation
METHODOLOGIES OF E E
Reflective Evaluation
CONTENT OF E E
Reflective Evaluation
OBJECTIVES OF E E
Reflective Evaluation
CURRICULUM EVALUATION
FORMATIVE EVALUATION
Feedback
Feedback
SUMMATIVE EVALUATION
Congruence or Discrepancy between intended and observed
CURRICULUM EVALUATION
Awareness
Knowledge
Skills
Attitudes
Participation
Formative Evaluation
Reflective Evaluation
(Congruence or Discrepancy between intended and observed)
Summative Evaluation
PUPIL EVALUATION

Figure 3–Integrative model of evaluation in EE

(c) knowledge of environmental issues and problems of resource management;

(d) competencies in environmental problem identification, investigation, evaluation and citizenship action;

(e) opportunities to develop value clarification skills and knowledge of the roles of human values in environmental issues.

There can be several approaches (forms) for introducing EE both in the pre-service and in-service teacher training programmes.

The option has to be left to the institutions to decide on the basis of the needs and the facilities.

In the pre-service programme, there can be either of the 3 approaches:

1. disciplinary with infused or inter-disciplinary content;
2. integrate with infusion of or multi-disciplinary content;

   or

3. a combination of both.

EE as a Separate Discipline

In this approach, EE is to be offered as a separate discipline with provision of a separate paper. Problems or units are selected and their concepts identified.

The concepts are discussed one by one from the content point of view by using appropriate techniques of teaching like observation, demonstration, experimentation, discussion, etc. Since content will be related to environment, it will also be used as technique for teaching the content. The level of the taught being the teacher trainees, the related higher concepts of environmental education may also be discussed in the course of teaching. This approach has to be activity based so that the trainees are well prepared for the task of teaching.

However, this approach has several other implications. It cuts across various subject areas and it will be necessary to coordinate such programmes with other subject specialisations. Another implication is to find time to teach this course separately.

Integration of Concepts of EE in Other Fields of Specialisation

In this approach the various concepts of environmental education may be integrated with other subject areas, such as Social Sciences, physical science and Humanities (Infusion or multi-disciplinary). This approach appears to be more practical because the related concepts of environmental education can be integrated with the relevant specialisation. Moreover, it will not increase the burden on the students.

In the in-service teacher training programme, one could adopt either of the following 4 approaches:

1. Contact Programme;
2. Development of Teachers' Guides and Self-learning Modules;
3. Correspondence Course;
4. Use of Mass Media.

Depending upon the needs and suitability.

Contact Programme

The contact programme can be of 3 to 4 weeks duration in which approach and methodology of teaching environmental education may be discussed. It can include demonstration lessons by the resource persons. Some selected units may be taken for actual teaching and discussed with teachers.

Development of Teachers' Guides and Self-learning Modules

Another approach for in-service training of teachers in environmental education can be by development of teachers' guides and self-learning modules on various concepts. The materials may be developed on programmed learning techniques and distributed to the teachers free of cost, if possible. It may be priced very low so that teachers are able to make use of it conveniently. It is, however, necessary that the teachers who are provided in-service training through this approach are evaluated to ensure that they have been benefited by the training. The evaluation may be done by asking the teachers to complete some assignment sheets or write answers to some question to be returned to the organising departments where these may be analysed and some remedial steps may be suggested and sent to teachers.

Correspondence Courses

The correspondence courses may be arranged by University Departments, Teacher Training Institutions, etc. Such courses have to be conducted in a well organised manner so that the materials reach regularly to the teachers. It is also necessary that the assignment sheets are obtained from the teachers in time, evaluated properly and sent to the teachers for their guidance. The materials may be well illustrated, so that teachers are able to perform the suggested activities.

The Use of Mass Media

The in-service training in environmental education can also be provided through mass media such as the newspapers, radio and the television. There is an increasing use of radio and television for providing in-service education in various areas, such as agriculture. The media can be used very effectively for in-service training of teachers wherever these are available easily and where teachers reside in far flung inaccessible areas.

It is thus evident that the environmental education programme has implications for both in-service and pre-service education of teachers. In order to implement it successfully, the models of programmes to be used in different approaches and instructional materials based on suggested model course should be developed by the concerned agencies.

Constraints and Difficulties in the Implementation of EE

Some of the problems have been mentioned earlier while discussing about implications of EE. Teacher preparation is likely to prove the greatest hurdle in the effective implementation of EE. This may be due to several reasons. Firstly, the total number of teachers to be oriented is too large. Secondly, to bring about a change of attitudes in teachers to develop a sort of commitment for the environment, which is the primary aim of EE, is a herculean task. Unless teachers are committed to EE goals objectives they cannot motivate their pupils. Further with advancing age it is difficult to bring in attitudinal changes. In in-service teacher training one of the factors involved is the time, because the teachers in service cannot be spraed from their schools for a long period of training. The second factor is the expenditure involved. If the period of training is long, the expenditure to be incurred for such a large number of teachers will be very heavy. The third factor is the availability of resource persons required for giving in-service training.

Some of the difficulties experienced in the implementation of EE by teachers are:

—the classroom teacher faces a problem in getting proper guidance to carry out some of the activities planned;

—supplementary and reference materials are not easily available;

—the teacher does not get administrative support unless fellow teachers, headmasters and supervisory staff are also properly oriented for the EE programme;

—the teacher gets little time for proper planning of activities;

—the teacher loses interest in the new approach in the absence of regular follow-up action;

— the insistence on completion of the syllabus places several constraints on teachers to be innovative.

The second area is with regard to value clarification which brings about a collective commitment to preserve and promote environmental quality. The environment has a 'local' and a 'global' aspect. One may start feeling helpless against deteriorating quality of his 'local' environment caused by decisions and actions of others in distant environments.

This may have serious relationship with value judgement. For example, what appears to be bad or unethical from an individual's point of view may be good from the national angle.

The Development and Coordination of EE at the School Stage in India

EE cannot work in isolation from the environmental management and developmental programmes in a country. EE can help only when it works in coordination with the environmental manageement and developmental programmes at all levels—national, state, district, block and community.

Actions related to the environment are the responsibility of the government. Unless a firm and judicious national environmental policy is formulated and suitable legislation made, the aims of EE as envisaged cannot be realised. Hence, the establishment of a National Council of Environmental Planning and Coordination (NCEPC) is suggested. (See Fig. 4) This can advise various ministries on planning, legislation and education regarding environmental matters. The Council would have access to a variety of expertise both in the public and the private sectors.

Problems and Tasks for EE

Some problems and tasks that need to be tackled or undertaken in connection with the implementation of the EE programme at the national level are:

—To prepars an Approach Paper in EE at the national level;

—To take suitable administrative decision/action for implementation of EE in schools at the national and the state levels;

—To examine and find the EE elements in the existing curricula through a national survey;

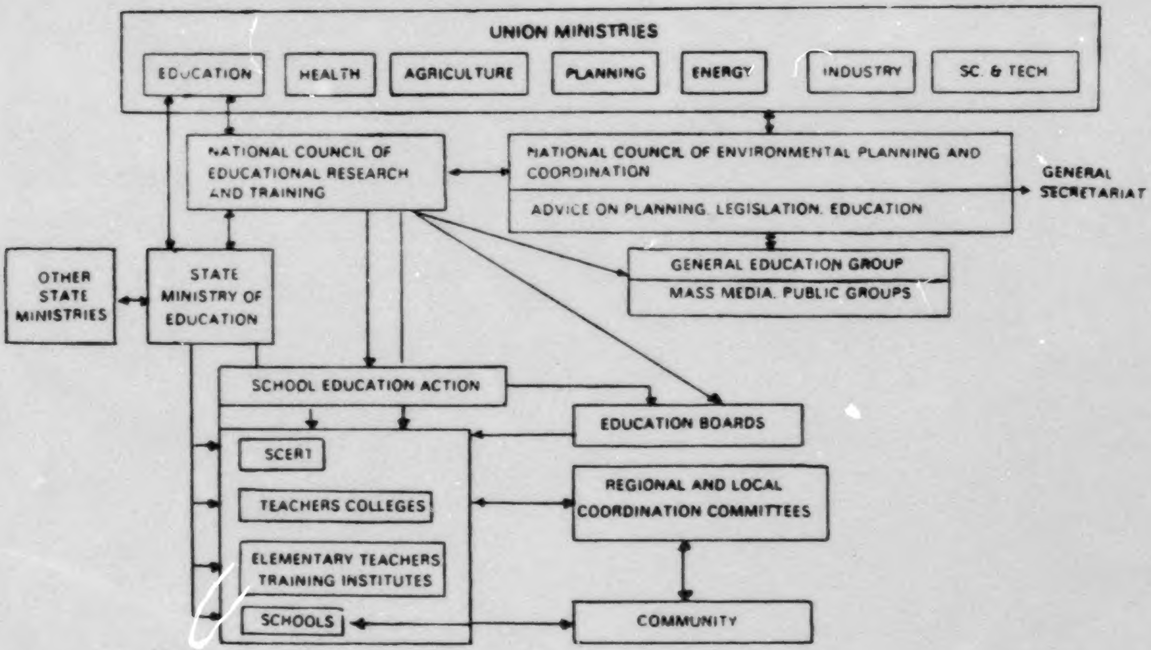

UNION MINISTRIES
EDUCATION
HEALTH
AGRICULTURE
PLANNING
ENERGY
INDUSTRY
SC. & TECH
NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING
NATIONAL COUNCIL OF ENVIRONMENTAL PLANNING AND COORDINATION
ADVICE ON PLANNING. LEGISLATION. EDUCATION
GENERAL SECRETARIAT
OTHER STATE MINISTRIES
STATE MINISTRY OF EDUCATION
GENERAL EDUCATION GROUP
MASS MEDIA. PUBLIC GROUPS
SCHOOL EDUCATION ACTION
EDUCATION BOARDS
SCERT
TEACHERS COLLEGES
ELEMENTARY TEACHERS TRAINING INSTITUTES
SCHOOLS
REGIONAL AND LOCAL COORDINATION COMMITTEES
COMMUNITY

Figure 4. -**Development and coordination of environmental education at the school level in India : an operational model**

—To develop on the basis of survey findings curricular materials in EE and to incorporate them in the school curricula;

—To plan and implement suitable teacher training programme in EE;

—To implement the EE programme and materials in school, linking EE with the needs and priorities of the local environment;

—To evaluate the impact of the programme from time to time.

The pledge for protection of environment has to be confined not only to specific regions or nations but has to be taken by all at the international level. Sooner we organise and join hands for a concentrated action in the matter the better it will be.

Acknowledgements

The author is thankful to NCERT for deputing him to present this paper at the International Conference on Environmental Education New Delhi, 16-20 December 1981 and to all those who participated in the preparation and whose names are acknowledged in the Lead Paper Environmental Education at the school level published by NCERT, India.

References

1. Institute of Culture. Cultural Heritage of India, Volume I, 1970, Ramakrishna Mission, Calcutta.

2. Trends in Environmental, Paris, UNESCO, 1977.

3. Strategies for Developing an Environmental Education Curriculum—A Discussion Guide for UNESCO Training Workshops on EE, Paris, UNESCO, 1980.

4. Reidel, Carl. Education (P. 46-50), Interdisciplinary Environmental approaches, Costs Mesa: California, Education Media Press, 1974.

5. Education and National Development: Report of the Education Commission 1964-66, Vol. 2, School Education, New Delhi, NCERT, 1971.

6. The Curriculum for the Ten-Year School—A Framework, New Delhi, NCERT, 1975.

7. Report of the Review Committee on the Curriculum for the Ten-Year School, New Delhi, Ministry of Education and Social Welfare, Government of India, 1977.

8. Atreya, B.D. Mishra A.K. Shri G. Guru. A study in the Area of Adapting Science and Technology Education to Changing Society and to the Diversity of Needs (UNESCO sponsored), New Delhi, NCERT, 1980 (Mimeographed).

Role of Universities in Environmental Education

D. SHANKAR NARAYAN*

The Environmental movement during the last 20 years made educationists everywhere in the world aware of the significance and importance of environmental education at all levels, in formal as well as non-formal education. A great deal of progress has been made to incorporate environmental awareness programmes into educational systems and to develop environmental sciences into a worthwhile, trans-disciplinary academic subject of study and research. Teaching of environmental sciences, its relevance in the colleges and universities, i.e. at the tertiary level of education, has been considered in depth in a number of seminars, symposia, workshops and conferences in this country during the last ten years with the purposes of clearly defining the scope of such studies and to formulate courses and curricula as well as to assess to some extent, the need for properly trained man-power for the newly emerging jobs in the environmental programmes within the country.

Presentation at this International Conference on the significance and importance of environmental education have referred to some of the major landmark events, both internationally and nationally in India, in the evolution of environmental education programmes and the role of educational system as well as all other agencies in promoting and establishing relevant programmes at different levels. The International Workshop on Environmental Education in Belgrade (1975), provided the now famous Belgrade Charter of guiding principles and basic objectives as well as identification of the audience for environmental education. The subsequent Inter-governmental Conference in 1977 in Tbilisi (USSR) orgainsed by the UNEP and UNESCO provided a whole set of well defined recommendations for action. The recommendation specifically related to the role of universities is directed:

—to review the present potential of the universities for conducting research, especially fundamental research, concerning environmental education;

---

*Addl. Secretary, University Grants Commission, New Delhi.

—to encourage acceptance of the fact that, besides subject oriented environmental education, interdisciplinary treatment of the basic problems of the inter-relationships between people and their environment is necessary for students in all fields, not only natural and technical sciences and arts, because the relationship between nature, technology and society mark and determine the development of a society;

—to develop different teaching aids and text books on the theoretical bases of environmental protection for all special fields to be written by leading scientists as soon as possible;

—to develop close cooperation between different university institutions (departments, faculties, etc.) with specific objective of training experts in environmental education;

—such cooperation might assume different forms in line with the structure of the university education in each country, but should combine contributions from physics, chemistry, biology, ecology, geography; socio-economic studies, ethics, education sciences and aesthetic education, etc.

The universities have thus been identified, as well as assigned to play an important role in teaching, training, research and extension as well as for production of learning and resource materials needed for environmental education. In other words, the universities have been given the responsibility of laying down principles, methods as well as applications in environmental education and environmental science research. While this is so, generally in respect of all universities, universities in countries like India participating in fast developing scientific, technological and social context, have the added responsibility of taking into account the wide disparities which obtain with regard to the rural-urban orientation, low literacy level, slow pace of change, a wide variety of socio-economic and environmental situations in designing and developing local specific programmes and activities.

Since Environmental Science and Environmental Education are relatively new, both with regard to content, methodology as well as approach, the universities have to essentially build an adequate body of knowledge and a systematic base of information sources and enable their sustained growth as well as define their relationships with other established academic disciplines of study within the university system. Obviously, such a body of academic knowledge as well as creation of a committed faculty and expertise should emerge out of a vast range of well-defined and properly implemented case studies related to our environment in the context of the impact of development of science and technology on environment. These case studies would cover several aspects related to soil, water, air, agriculture, forestry, flora and fauna including wild life, population structure, public health, pollution, poverty, productivity, conservation and management, resource utilisation, industrial development, urbanisation, integrated rural development, communication and transportation, biosphere reserves, genetic engineering, appropriate technologies and a whole range of other situations of crucial value and importance to national economic development. Generation of accurate, reliable and up-to-date information and creation of knowledge, development of necessary skills, values and attitudes, of how to maintain, protect and improve the human environment through relevant education programmes are therefore a basic concerns of the universities.

The teaching aspect of environmental education within the colleges and universities is not only for purposes of providing basic information and knowledge essential to bring about an environmentally literate youth, and citizens with concern for environmental problems and acquisition of basic skills for initiating elementary action but to commitment of measures for good environmental management as well. This is made possible by integration of appropriate units of studies and restructuring of courses of study to emphasise to the extent necessary in all subjects, those relevant aspects related to Ecology and Environment and humanity's critically responsible presence and role in it. Such a youth would be able to participate with a sense of responsibility and urgency regarding environmental problems and solutions. The other important development in teaching is to design specific courses and curricula appropriate for undergraduate and post-graduate studies on a trans-disciplinary basis, to provide for an adequate level of comprehension and assessment of the total environment and its related processes and problems. These studies, while providing for some core courses, would also provide for necessary bias towards biological or physical sciences or have a distinct engineering and technology orientation, as well as enable students to take up a project work of local relevance and related to a well identified environmental problem. Both these approaches would contribute to general environmental education as well as education of professional groups and environmental scientists and technologists.

The supporting organisational structures required for the development of such academic programmes have become available either within the existing departments of studies, often brought together within an inter-departmental school of studies and in some cases by setting up separate centres for environmental sciences Such departments or centres or schools have tried to deal with the environment in its totality, both natural as well as man-made, and have endeavoured to clearly define the objectives and scope of the individual courses, to lay emphasis on understanding of basic concepts, dynamic processes as well as qualitative aspects and assessment of the studies for appropriate evaluation by drawing upon resources and methodologies available from different disciplines in sciences and social sciences. A number of workshops, seminars and symposia have been organised for the specific purposes of development of curricula, courses of study and identification of urgent problems requiring research effort and solutions.

Based upon the development of infrastructure facilities and the expertise available in an institution, the university system has provided for teaching, training and research in environmental sciences by reorienting teaching of the existing courses to provide for an ecological and environmental bias as well as by restructuring of undergraduate courses to include environmental sciences as one of the subjects of studies at the undergraduate level on the same basis as Physics, Chemistry, Mathematics, Botany or Zoology. At the postgraduate level, study of environmental sciences has been provided as one of the areas of specialisation in a large number of universities while some of the universities have developed a full two-year programme in environmental sciences with emphasis on biological or physical sciences based upon the background of students coming from different streams into the postgraduate level. A model curriculum emphasising the inter-disciplinary nature and consisting of unit courses has also been suggested for the purpose. A few other universities have provided M.Phil programmes in environmental sciences besides opportunities for working for a doctoral programme. For example, the School of Environmental Studies at Jawaharlal Nehru University, provides both M.Phil and M.Sc. degree programme and the curricula include a set of core subjects, subject group courses for students drawn from different subject orientations and a number of short courses and project work in areas of environmental physics, environmental biology, geology, chemistry and environmental management. Similarly, the School of Environmental Sciences in Poona University has chosen programmes with a rural bias in the four geographic and economic settings in Maharashtra. The Awadesh Pratap Singh University at Rewa (Madhya Pradesh) has a fullfledged Master's degree programme in Environmental Biology. The Cochin University offers several short-term part-time courses as continuing education programmes. The other universities offer Environmental Biology as an option at the Master's level. The overall trend, therefore, is to develop courses with a thrust either in Biological or Physical aspects of environment and to relate studies to emerging problems of regional importance such as resources, energy studies, spatial distribution and land use and in some cases, to engineering aspects. Environmental Engineering has mainly evolved from the erstwhile Sanitary Engineering and Public Health Engineering precepts, and is based on Engineering technologies. Today, the field has expanded greatly in scope and content, not only to keep the existing knowledge of water supply, sewerage treatment and disposal and sanitation but also to cover aspects of control of water and air pollution and interaction. Environmental Engineering is generally confined to post-graduate level courses but attempts are being made in the graduate level training to provide for options for study and careers in Environmental Engineering and Technology.

While academic teaching and training programmes have been evolving gradually, essential information-base and knowledge relevant to the environment of the Indian subcontinent, is being generated and strengthened through research output of well defined projects funded by a number of national agencies such as U.G.C., C.S.I.R., D.O.E., D.S.T., etc These cover a wide spectrum, including studies on (a) Biological indicators of environmental quality; (b) Analysis of organic pollutants in water and waste water; (c) Environment and mercury contamination; (d) Solid waste treatment and disposal; (e) Analysis of air pollutants and quantitative analysis; (f) Process of desertification; and (g) Biological productivity studies.

A variety of problems arising out of the state of the environment encompass issues of population and poverty, population and pathology, land use and productivity, conservation of resources, waste utilisation, bioproductivity and bio-energetics, dynamic eco-systems assessment and geography of epidemics and diseases.

Some universities have also initiated suitable externsion activities, not only through short-term courses but by interacting with local communities in bringing about awareness to emerging environmental problems and efforts to find local solutions to such problems, and to stress the integrated nature of man's relation to natural and cultural landscape and their importance in human ecology and environment, designing and planning landscape ecology and architecture, etc..

Training of manpower in the Environmental Sciences and

Technology is a keyfactor in developing programmes related to environment and it is a challenge to be met adequately by the country's own educational system, particularly the universities. According to UNESCO, there are at least two major reasons why such over-riding priority is to be given to the question of trained manpower. First, trained endogenous manpower enables countries to adopt new kind of development, based on self reliance and with reference to national policies for natural resource development and management of resources. Second, the development of a core of environmental specialists is a *sine qua non* condition for developing programmes of education which respond to national goals and to national socio-economic, cultural and ecological conditions. Such programmes correspond to a large extent to what is meant by environmental education. A core of such trained manpower is required for a variety of educational functions at the national level, including:

- —to train teachers and provide them with materials based on local experience and local examples which they can use in their lessons;
- —to provide objective scientific information on environmental problems to the general public, and to interact with local populations and respond to their information needs;
- —to help orientate the training of those whose activity and influence have an important bearing on the environment, for instance, engineers, architects, administrators and planners, industrialists, trade uniorists, policy-makers and agriculturalists;
- —to increase awareness of decision makers and planners of the types of information that scientific research can generate;
- —to undertake research on the attitudes and perception of local populations to their environment, in order to assist to designing educational approaches;
- —to manage natural reserves for education and demonstration purposes;
- —to extract information from local government schemes which can be used as case studies in programmes of environmental education.

These are tasks which can only be undertaken by environmental specialists to be trained by the universities. Training in these fields cannot be divorced from research, since these are intimately linked through such relations as "Training for Research" and "Research for Training" and would result in a critical size of trained manpower, capable of mutual interaction and also to generate newer training/research programmes and thus contribute to a continuity of scientific endeavour and to national development.

Role of Universities in Environmental Education and Research

R. SUBRAMANIAN*

> *"A university stands for Humanism, for tolerance, for reason, for the adventure of ideas and for the search of truth. It stands for the onward march of the human race towards even higher objectives. If the universities discharge their duties adequately, then it is well with the Nation and the People."*
>
> —Jawaharlal Nehru

James A. Perkins, Chairman, International Council for Educational Development, described the functions of an university as follows:

(a) Mission of Teaching

(b) Mission of Research

(c) Mission of Service to Society

(d) Mission of Creating an Ideal Democratic Community

Environment, Ecology, Pollution are the words commonly used nowadays in universities, research etc. Since these words have broad meanings, varied research is being carried out in various departments of universities and colleges. In India, the resources are limited, but avenues for research in environment are many. Hence, it would be wise, to coordinate all our research efforts.

In India, government agencies like Department of Environment, Department of Science and Technology, Department of Ocean Development, Council of Scientific and Industrial Research, Indian Council of Medical Research, Indian Council of Agricultural Research, Indian National Science Academy, Indian Space Organisation, Department of Atomic Energy and also various state level agencies are funding for research, both in universities and elsewhere.

---

*Assistant Professor, Centre for Environmental Studies, Perarignar Anna University of Technology, Madras.

The Department of Environment, Government of India budgets a major expenditure on research in the field of "Environment" (Table A).

TABLE A

Facts for 1980-1981 on University Research

No. of Universities	*Approximately 110*
Research Outlay, Annual.	85 lakhs
No. of R and D Projects funded by Environmental Research Committee (ERC) and Indian National Man and Biosphere Committe (MAB)	100
Projects supported in Universities	49 (out of 100 funded)
Projects on Biological Sciences	90

The Environmental Research Committee (ERC) of Department of Environment has listed out the fields of interest pertaining to Indian Environment.

Likewise, the other funding agencies can also identify areas of research in environment, especially in the field of agriculture, medicine, engineering, etc. At global level, the United Nations Environmental Programme (UNEP) can also identify broad areas of research for the guidance of universities.

The universities, with existing and established departments like Botany, Zoology, Chemistry, Physics, Mathematics, Economics etc. should interacting among themselves and identify major environmental problems relevant to their respective areas, and find solutions for them.

It is also well known that to achieve a pleasing environment, the concreted efforts of academic institutions, professional societies, government agencies, private industry and the public are necessary. Thus the university could play a major role taking up of research oriented problems specifically. Universities also could play a vital role in the following research problems:

1. To clarify or validate a theory;

2. To clarify contradictory findings;
3. To correct faulty methodology;
4. To correct inappropriate use of statistics;
5. To resolve conflicting opinion;
6. To resolve conflicting research problems.

But while attempting these types of environmental research, the universities may be hindered by the following factors:

1. Lack of funds;
2. Lack of training (training of researchers);
3. Bridging the gap between theory and practice; and
4. Uncritical acceptance of research findings and methods.

Then it is upto the university to find a solution. Governmental agencies and other non-governmental agencies can only support this role.

In India, environmental education is at a primitive stage; especially at university level. Environmental Science is not a separate discipline by itself, but has evolved in recent years from the basic disciplines. The manpower requirement for tackling various environmental problems is also huge in the coming years. Hence universities should start the discipline of Environmental Science at the under-graduate, post-graduate and research degree levels. With the available facilities in basic disciplines, it is possible for the universities to start courses, integrating various subjects. Environmental Science, being inter-disciplinary in nature could be well fit in as an academic programme of the universities. In this discipline, the teaching could be oriented to a particular aspect of environment, namely health, agriculture, toxicology, environmental chemistry, environmental biology, environmental geology, etc. To quote an example, the University of Madras has approved the starting of an M.Sc Course on Environmental Toxicology, which incorporates inputs from marine biologists, pharmacologists, toxicologists, forensic toxicologists, geneticists and clinicians.

Other courses with different bias as follows could be started.

Agriculture Bias

Entomology, Parasitology, Epidemiology of farm animals and diseases, Physiology of reproduction, Lactation and growth, Pisciculture, Poultry, Dairy and Food Hygiene.

Public Health Bias

Immunology, Environmental Pollution, Epidemiology, Nutrition and Disorders, Human Genetics, Human Physiology and Bio-chemistry and Toxicology.

In addition to above, the faculty members of various universities dealing with environmental studies can conduct summer institutes for:

1. teachers of high schools
2. select number of upper division under-graduate student especially in subjects like Public Health, Urban Planning, Geography, and Architecture.

These in turn could dissipate the knowledge in a convenient manner to the rest of population. This recycling of environmental knowledge will certainly have impact in communities. Besides this, the university environment departments can have other activities as:

1. *Teachers' Training*: Teachers of Schools, Colleges to be trained in various aspects of environmental problems.
2. *Professional Environmentalists Training*: mainly on Environmental Health.
3. Conducting research on teaching strategies and techniques used in school and community environmental education.
4. Conducting research on individual and community motivation techniques used in environmental education.

The university could be a truly effective factor of environmental change through education and interaction with all sorts of environmental professionals, particularly health environmentalists, with specialisation in Human Urban Ecology. The university should also strive to support the creation of an environmental health value system similar to that of personal health value system.

Stepp (1974) defined environmental education as "Environmental Education is aimed at producting a citizenary that is knowledgable concerning the total environment and its associated problems, aware and skilled in how to become involved in helping to solve these problems, and motivated to work toward their solution."

References

1. Department of Environment, Government of India, Annual Report 1980-81.
2. Foundations in Educational Research, edited by Gilbert Sax, Prentice Hall, New Jersy.
3. International Conference on Environmental Education, Abstracts edited by J.C. Bhat and Desh Bandhu. Dec. 16-20, 1981, Vigyan Bhawan, New Delhi.
4. Proceedings of the Workshop on Environmental Education. Edited by Anjali Mookerjee and Balraj Bhatra, published by M. Abdu Munim, Science and Environment, Aligarh, 1981.

Role of R & D Institutions in Environmental Education

B.B. SUNDARESAN*

Introduction

Institutions involved in research and development in the area of environmental sciences and engineering focus on interdisciplinary approach to critically analyse and indicate scientific methodologies to minimize environmental damage. Technological processes and engineering skills could then be adopted to provide practical solutions for field problems as they emerge out developmental activities. In promoting application of technological and engineering solutions to minimize environmental damage, social and cultural aspects become equally relevant. Developmental programmes to improve the quality of life are essential. In this endeavour, if the environment and ecosystems get degraded, the very basis of the developmental programmes become irrelevant. The problems of environmental damage should then be solved through rational scientific basis applying technological and engineering skills without overlooking social and cultural issues. Interaction among such an array of disciplines, involved in enviornmental planning, compatible with social aspirations for better quality of life becomes extremely complex. Each scientific discipline tends to go deep in one area alone, unmindful of other issues. An optimum level of probing and performance by each discipline represented in environmental planning thus becomes relevant.

R & D institutions should focus on top level planners, administrators and technocrats involved in the developmental planning to expose them to environmental impact and analysis of developmental activities. The top level professionals involved in developmental progammes have not responded to environmental issues to the extent required. The whole concept of environmental impact analysis and assessment should be institutionalised so that it becomes part of the planning process.

---

*Director, National Environmental Engineering Research Institute, Nagpur, India.

Guiding Principles

The Tbilisi conference[1] outlined the goal of environmental education to:

(i) foster clear awareness of, and concern about, economic, social, political and ecological interdependence in urban and rural areas;

(ii) provide every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment; and

(iii) create new patterns of behaviour of individuals, groups and society as a whole towards the environment.

It should then focus on various target groups which are involved in developmental activities for which the guiding principles should be:

(i) to consider the environment in its totality—natural and built, technological and social (economic, political, cultural-historical, moral, aesthetic);

(ii) interdisciplinary in its approach, drawing on the specific content of each discipline in making possible a holistic and balanced perspective;

(iii) examine major environmental issues from local, national, regional and international points of view so that students receive insights into environmental conditions in other geographical areas;

(iv) focus on current and potential environmental situations while taking into account the historical perspective;

(v) promote the value and necessity of local, national and international cooperation in the prevention and solution of environmental problems;

(vi) explicitly consider environmental aspects in plans for development and growth; and

(vii) emphasize the complexity of environmental problems and thus the need to develop critical thinking and problem-solving skills.

Target Groups

Professionals involved in policy planning, decision-making and managerial level should be the target groups that need be exposed to environmental issues by R & D institutions. Short duration appreciation courses should be conducted for top level professionals, administrators and technocrats. The middle level technologists and engineers involved in design, construction and execution of industrial and other developmental projects also need be exposed to environmental impact analysis (EIA). Environmental impact appraisal should ensure that the environmental and health impacts of actions, projects, technologies and policies are given proper consideration in the decision-making process. It should include (i) diagnosis of environmental conditions and health situations before commencement of the proposed action; (ii) assessment of the impacts of the proposed action on physical environment, ecology, socio-economic conditions, cultural, environment and health; (iii) evaluation of the foreseen impacts as to their extent, duration, severity and importance; (iv) identification of alternate courses of action that would eliminate or reduce negative impacts or maximize positive impacts; (v) the identification and modification and safeguards which must accompany the action; and (vi) the establishment of monitoring and feedback mechanisms[2].

Environmental impact appraisal should be compatible with political, social and administrative systems in the countries concerned to ensure effective integration of the same in the planning and decision-making process. Shortage of qualified multidiscipline man-power, insufficient data and information base and lack of indigenously tested methods of EIA are some of the constraints.

Indian Scenario

The problems of increased developmental activities manifested itself through water pollution on a large scale and air pollution to a limited scale in India. This led to comprehensive legislation at the national level to control water and air pollution and has ultimately resulted the formation of a Department of Environment at the national level. Various functional departments of the Central Government have initiated action to have advisory committees on environment. At the State level, committees have been constituted to advise on specific matters concerning environmental protection.

Large developmental projects like fertilizer, petrochemicals, thermal and hydroelectric power plants and mining activities have been undertaken and several more are likely to be undertaken. Expert committees are appointed to assess the unfavourable impact on the environment and suggest measures to minimize the damage. Such committees process the data and information about the proposed projects, identify the environmental parameters and project activities, evaluate the social, economic and ecological impact, suggest the process modifications, if any, and provide guidelines for the government to take a suitable decision. An objective assessment is made in spite of limitations of data and quantified information. The recommendations of the committee are not binding but are given due consideration before a decision is taken. In fact, based on such reports, a hydroelectric project in Tamil Nadu was abandoned; an expansion programme of a thermal power station in Delhi was deferred, just to name a few. The sequence of operation for environmental impact statement is indicated below[3].

Environmental degradation can occur due to (i) lack of development and lack of basic utilities; (ii) industrialisation, urbanisation and agricultural development; and (iii) low economic level of people. It should be recognised that low economic level and pollution go together and as such, environmental impact analysis and assessment become a complex issue in developing countries.

There is a fairly large possibility of biases occurring during this process. Impact is a strong function of prior experience and beliefs. For example, deforestation occurs in a number of projects. But, the negative consequences are discounted since we have already experienced deforestation. Intensive irrigation has caused malaria in a number of locations. In evaluation of various possible impacts, historical data will be required. In the absence of extensive data regarding past, further data collection becomes essential. Since our knowledge, data and information base regarding environmental risks are insufficient, it is difficult to fix acceptable environmental standards which will not generate irreversible ecological damage. One example is the impact of toxic substances to aquatic systems. Our present state of knowledge regarding toxicity interactions, specificity of toxicity since it differs from species to species and lack of ecological data relevant to our agro-climatic, hydrogeological and biological environment, makes it difficult to arrive at precise impact assessments. This further strengthens the need for a group of highly interdisciplinary experts specialised in impact analysis and environmental management.

It will be prudent to expose the top level professionals to environ-

1 **Project** : Aim, scope and description

2 **Information** : Location, agriculture, demography, meteorology, economic level - present and anticipated, technology, water and fuel needs, ecology and environment activities during construction and operation stages, historical information.

3 **Identification** & Evaluation

a) 'Activities' like solid, liquid wastes, quantity & quality, gaseous, emissions, displacement, human settlement, landscape, vegetation, water courses, aquatic flora, fauna, hazards, etc. → b) 'Effects' on environment, air, land, water and human settlement, resource conservation, benefits.

4 **Suggestions** : Regarding control/treatment/disposal alternatives, alternate sites, recycling, etc.

5 **Analysis & Assessment** : Analysis on the effects and resultant impact on environment with reference to various activities arising from project/industry, and when there is no project. Cost benefit, and risk benefit aspects, assess the effects and impact on the environment for alternatives including 'status quo' condition.

6 **Impact Statement** : Impact of 'development' on the various facets of environment by providing clear and brief presentation in a report form on environmental implications (with relevant supporting information and data) for alternatives and recommendations on pollution control, process selection, environmental management, planning of human habitat, and site selection including ' no action '.

mental issues through series of appreciation courses rather than wait for the next generation who would have been exposed to environmental education from their school days. The developmental activities continue to grow in magnitude and the number of management personnel continue to increase; bulk of whom have yet to be fully exposed to environmental issues. A few typical appreciation courses are:

(i) Environmental impact analysis and assessment

(ii) Systems approach in environmental planning

(iii) Environmental risk management

(iv) Project appraisal and environmental guidelines in developmental planning

(v) Impact on aquatic ecosystem due to water pollution

(vi) Air and water quality modelling

Table I indicates that a number of institutions and government departments are already involved in various aspects of environment in India. The list is impressive though some of them may be involved only marginally. The topics coverd and disciplines represented show the variety and diversity of scientific and technological disciplines. It would be difficult for bringing together all of them to a common forum, but the experts from these institutions should be able to provide appreciation courses to policy planners and administrators.

TABLE I

R & D Institutions Involved in Environmental Aspects in India

Sr. No.	*Subject Disciplines*	*Key Institutions*
1	2	3
1.	Atmosphere and climate	Indian Meteorological Deptt., NEERI, Nagpur
2.	Oceans, seas and estuaries	NIO, Goa; Central Board for Prevention and Control of Water Pollution; Central Water Commission; Deptt. of Environment
3.	Inland water (surface & ground water)	CBP & CWP, Delhi; NEERI, Nagpur; Central Water Commission; Central Inland Fisheries Res. Instt., Calcutta
4.	Energy, resources, supply and use	Tata Energy Res. Instt., Bombay; DST; Central Electricity Authority; BARC; NPL, Delhi; CFRI, Dhanbad; Central Power Res. Instt., Bangalore

1	2	3
5.	Physical, chemical and biological processes	NCL, Pune; Zoological Survey of India, Calcutta; Botanical Survey of India, Calcutta; NBRI, Lucknow; NEERI, Nagpur; ITRC, Lucknow; CSMCRI, Bhavnagar; Madurai Kamraj Univ.; NPL, Delhi, BARC; Bose Instt., Calcutta
6.	Disasters including man made disasters	NGRI, Hyderabad; India Meteorological Dept.; GSI, Calcutta; Central Water Commission; IARI, Delhi; National Fire Res. Instt., Roorkee
7.	Renewable resources	NGRI, Hyderabad; GSI, Dehradun; Central Water Commission; IARI, Delhi; Forest Res. Instt. & College, Dehradun; BARC; CSMCRI, Bhavnagar
8.	Land surface	IARI, Delhi; Town and Country Planning Organisation, Delhi
9.	Food and agriculture and all agricultural universities around the country	IARI, Delhi; Central Arid Zone Res. Instt., Jodhpur; International Crops Res. Instt. for the Semi-Arid Tropics, Hyderabad; Food Technology Res. Instt., Hyderabad
10.	Animal life including wildlife	Zoological Survey of India, Calcutta; World Wild Life Fund, India, Bombay; Bombay Natural History Society, Bombay
11.	Plant life	NBRI, Lucknow; Botanical Survey of India, Calcutta
12.	Population	Registrar General of India, Delhi; National Instt. of Health & Family Welfare, Delhi
13.	Human Settlement	Town and Country Planning Organisation, Delhi; School of Planning & Architecture, Delhi; CBRI, Roorkee; Archaeological Survey of India, Delhi
14.	Human health	NIOH, Ahmedabad; CDRI, Lucknow; NEERI, Nagpur; AIIH & PH, Calcutta; All India Institute of Medical Sciences, Delhi; Indian Instt. of Experimental Medicine, Calcutta

1	2	3
15.	Transport	Automotive Res. Association of India, Pune; Central Instt. of Road Transport, Pune; CRRI, Delhi
16.	Environmental technology and industry	AIIH & PH, Calcutta; NEERI, Nagpur; ITRC, Lucknow; IITs, Kapur & Bombay; Perarignar Anna Univ. of Technology, Madras; Univ. of Roorkee; VJTI, Bombay, M.S. Univ. of Baroda
17.	Monitoring and assessment including modelling	DST, Central and State Boards for Prevention and Control of Water Pollution; NEERI, Nagpur; BARC, IIT, Bombay; Perarignar Anna Univ. of Tech., Madras
18.	Management & Planning	DOE, Delhi; Indian Instt. of Management, Bangalore; Town & Country Planning Organisation, Delhi
19.	Socio-economic aspects	Indian Council of Social Science Res., Delhi; Indian Council of Applied Economic Res., Delhi, DST; Council for Social Development, Delhi; Tata Instt. of Social Sciences, Bombay
20.	Education & training	National Council of Education Res. & Training, Delhi; IITs.; Roorkee Univ., JNU, Delhi; Jadavpur Univ., Calcutta; Perarignar Anna Univ. of Tech., Madras; Univ. of Bombay; M.S. Univ. of Baroda; Madurai Kamaraj Univ.
21.	Statistical information pertaining to environment	DOE, Delhi; NEERI, Nagpur; Indian Instt. of Bangalore; Central Statistical Organisation, Delhi; CPHEEO, Delhi; DGHS, Delhi; National Instt. of Health Education, Delhi
22.	Waste treatment including re-use	NEERI, Nagpur; CBP & CWP, Delhi; Central and State Boards for Prevention and Control of Water Pollution; Forest Res. Instt. and College, Dehradun; FRI, Dhanbad; Perarignar

1	2	3
		Anna Univ. of Tech., Madras; IITs, Delhi; Bombay, Kanpur; M.S. Univ. of Baroda; VJTI, Bombay; NML, Jamshedpur; ICAR
23.	Legislation	DOE, Delhi; Central and State Boards for Prevention & Control of Water Pollution
24.	Standardisation	ISI
25.	Impact of development	DOE, Delhi; Central Water Commission; Central Board of Irrigation & Power
26.	Soil transformation including desertification	Central Arid Zone Res. Instt., Jodhpur; IARI, Delhi
27.	Mineral	IBM, Nagpur; GSI, Calcutta; CMRS, Dhanbad; NGRI, Hyderabad
28.	Areas of historic, archaeological and tourist interest	Archaeological Survey of India, Indian Tourism Development Corporation

Environmental Education for Physical Planners

A.J. CONTRACTOR and JITENDRA SINGH*

Introduction

The general deterioration in the natural, and man-made, environment is a source of grave concern all over the world. It is, now, well recognised that in order to check further deterioration, environmental studies—comprising many disciplines—are urgently required to be applied to a wide range of complex problems.

An overview of the settlement pattern, structure and conditions, would reveal that they are confronted with intrinsic problems, whose gravity magnitude and proliferation was not evident till recent times. The state of services, transportation, communication, settlements, and many other public facilities, has improved in recent times, but it has not attained the desired level; on the contrary it has often indirectly, resulted in many of the human settlements being convulsed and paralysed, due to a piece-meal approach at solving the problem. Conditions are more grim and acute in developing countries, such as India.

These may be due to:

(i) non-availability of trained administrators, planners and allied professionals, and

(ii) ignorance in social values/obligations and the environment (man-made or natural), as a whole.

Causes of Present Conditions

Much of the damage to our settlements and the environment has been caused by inappropriate technology, as a consequence of misunderstanding, or lack of knowledge, of man-made and natural systems. The absence of proper understanding and appreciation, of man-made systems and technology, so as to channel them in less destructive areas, has re-

---

*Professor and Reader respectively in Department of Architecture and Planning, University of Roorkee, Roorkee.

sulted in the development, and adaption, of a "crisis-oriented" technology. A total lack of knowledge, of human, physiological systems, vis-a-vis the environment, has resulted in the problems which most of our urban/rural settlements are now facing. It is due to this that many areas of our urban/rural communities are becoming less congenial and habitable, to the detriment of ideal human values and welfare. There is frustration and indifference in the cities, because of over-crowding, congestion on roads, neglect of essential services, filth, stench, noise, pollution of air and water, and a host of other, similar evils, which assail our senses and dull our sensibilities.

Need for Environmental Awareness among the Professionals and the Public

The present situation demands a great deal of attention to be paid to the impact of development on nature, in order to check, (a) further, rampant violation of the natural ecosystems, and (b) the indiscriminate exploitation of depleting, natural resources. This is due to the universally accepted fact that, if this trend continues unchecked, it will lead to the annhilation of all life-forms on this planet. Therefore, professionals and all those involved in decision-making, regarding the future course of our settlements, should recognise, and appreciate, the importance of the problems cited above, and make the right decisions which would enable our settlements—and mother-earth—to sustain the onslaughts of MAN for a longer time, if not for ever.

This calls for a concerted drive for environmental education and awareness among people in general, and those professionals in particular, who are responsible for the planning, construction and decision-making processes, of these settlements.

Modification of Past Knowledge in Physical Planning, Applied Sciences and the Education-Programme, to Suit Present Conditions

Urbanization has been accepted as one of the most significant social, cultural and political processes of our times. This phenomenon has been responsible for altering the life-styles and welfare of millions of people, sometimes it has resulted in providing a better environment, but more often its benefits have been of a doubtful nature, mainly due to natural processes being completely neglected, either in a hurry because of dealing with situations on a crisis-footing, or purely due to lack of understanding and adequate knowledge. It is in this process of urbanization that the increasing numbers of industries, automobiles, people and accompanying technological parapheraelia, all add up to tremendous pollution levels in the atmosphere, water, noise and on land. Moreover, we are just beginning to think in terms of setting up legal machinery to check this rampant spoilation of our environment, and our educational programmes are, also, not developed enough to tackle this problem with any reasonable degree of effectiveness.

The following list of areas would be of help in formulating objectives which we are trying to achieve through the planning process:

(i) Preservation of ecological systems, so as to ensure a continued supply of life-supporting resources.

(ii) Adequate and appropriate land-uses to be allocated to different lands, so as to safeguard the general interest of the masses and the community as a whole, rather than protecting the specific interests of a select minority of influential individuals.

(iii) Also, after determining land-uses, for various kinds of land, the better varieties could be protected from damage and deterioration, while the inferior types could be improved for maintenance of life-support systems.

(iv) The man-made environment should be developed so as to provide healthy living conditions and minimise damages to the physical/mental conitions of mankind; this can be achieved by developing the total environment at the micro and macro levels, instead of piece-meal attempts at development.

(v) The physical and natural environment should be made to look attractive and aesthetically pleasing to the public.

(vi) In all attempts at development, sincere efforts should be made to preserve and adopt the good qualities of the natural environment.

(vii) Improving conditions for human welfare should be the prime objective in all development projects.

(viii) Social and administrative institutions should try and provide all the help they can, in developing and maintaining good environmental qualities, in their surroundings.

x) All major factors affecting the environment due to human impact, should be considered and anticipated in the planning process, before the project is implemented.

(x) Planning should be comprehensive; it should include the full range of physical, biological and human factors operating in the region.

The planning process has become very complex, in the present times, due to the great advances made in the fields of science and technology. Today planning requires a wide range of skills and methodologies, which go well beyond data collection and analysis; to be effective, planning must be based on sound, scientific and technological, knowledge supplemented by long experience. Also, in order to arrive at the comprehensive, development-plan stage, we need detailed information in the following, broad categories:

(i) Physical factors

(ii) Biological factors

(iii) Socio-phychological factors

(iv) Economic factors

(v) Demographic foctors

(vi) Design factors

(vii) Cultural and historical background

(viii) Administrative and political institutions

(ix) Development of the built-environment

This information would act as a necessary base, not only in understanding the inter-relationship between the various elements of the ecological system but would, also, help in projecting information pertaining to future goals, and in the preparation of alternative models for achieving those goals; without this information-base, it would be almost impossible to arrive at realistic conceptions of what is likely to occur in future, in view of so many varying conditions.

The data collection for various factors cannot be possibly done by an individual, as such, for arriving at an effective and complete planning process, involvement of individuals with specialisations would be necessary. All of them could work under one coordinator, and could collaboratively deal with the intricacies of each major factor so that a plan could be developed, which is in accordance with natural processes and systems, to the maximum possible extent.

Suggested Educational Programme

It is obvious that the planning process needs specially trained professionals and individuals possessing special skills. In this regard, although Architectural Planning, Educational Institutions are making significant progress and contribution in imparting education in the principles and techniques of physical planning, yet it is now generally accepted that a new kind of awareness towards the environment is extremely necessary. This would need an educational programme for preparing professionals adequately, in incorporating environmental considerations in physical planning. Such a programme should be based on the following broad objectives:

(i) Understanding man's role, and place, within the total environmental framework; knowing the interaction between (a) man and environment, and (b) socio-cultural and natural forces and thereby forming an integrated picture of man within his natural environment.

(ii) Incorporating environmental education in physical planning, thereby preparing for the future with the hind-sight, and experience, of the past.

(iii) Understanding the planning-process as an integral part of natural processes and phenomena.

(iv) Changing the attitudes of planners and technocrats, from an antiquated and motivated approach towards the planning process, to a highly comprehensive one, which would, hopefully, result in the general well-being of mankind.

(v) Modifying existing legislation in order to incorporate factors pertaining to environmental considerations also.

(vi) Finally, in utilizing all available sources of knowledge and skills, in various disciplines, to enhance the interactions between man and environment and thereby, to result in a better, and more positive, man-environment relationship.

Conclusions

The proper and complete understanding of a system, whether man-made or natural, is essential to be able to follow the same. Most of our actions in the past have gone contrary to the processes of nature and its ecosystems, resulting in a severe threat to the very survival of mankind on this planet. The main cause of this situation had been the negligence and unawareness of all those who should have been concerned about nature. The situation is very complex. To tackle it and to bring it on the right lines would need a thorough understanding of nature and its intricate processes. This would require all planners and technocrats be made well aware of natural laws and processes so that these could be incorporated in the course of planning the settlements; and an infrastructure be created which would not disturb the environment, but rather, be in harmony with nature.

References

Lasey, William R., Planning in Rural Environments, McGraw Hill Book Co., 1977.

Golany, Gideon, International Urban Growth Policies, John Villey and Sons, N.Y., 1978.

Forrester, Jay W., Urban Dynamics, The MIT Press, England, 1969.

Branch, Melville C., Planning Urban Environment Dowden, Hutchinson and Ross Inc., 1974.

Singh., J., Preservation of Environment, Ecology and Aesthetics of Rural Settlements within the framework of urban development, 29th ITPI Seminar, January, 1981.

Proceedings of All India Seminar on Environmental Education, Rajasthan University, December, 1976.

Environmental Management Education: An Indian Experience[*]

N.L. RAMANATHAN[1] and B. BOWONDER[2]

Introduction

Environmental management is one of the most critical inputs for achieving ecologically sound and balanced economic growth. Unless policy makers and administrators are aware of the significance, principles and practice of environmental management, planned implementation of essential environmental protection measures will neither be adopted nor be effective. Environmental management training programmes for decision-makers are, therefore, urgently needed. The Department of Environment has initiated training workshops for top level managers with the intention of sensitizing them to environmental management practices. This paper gives a brief summary of an experience in organising and conducting such a programme.

Genesis

The Department of Environment promotes environmental management; but so far most management institutions have not begun taking active interest in this area either in research or training. In 1979, the Administrative Staff College of India was approached by the then Environment Division of Department of Science and Technology (The new Department of Environment was created in November 1980) for organizing a joint workshop on Environmental Management. The idea was accepted in principle and one workshop for government administrators was organised in March, 1980. This experimental workshop attracted satisfactory participation by a spectrum of government officials. The faculty included experienced guest lecturers, drawn from government and accademy. In view of the fairly good response for the first workshop, a second workshop on Environmental Management was arranged in March 1981. This paper recounts our experience regarding the second workshop, which, it was thought, could be a model for a series of such in-service training programmes.

---

[*] These are the views of the authors and they do not necessarily represent their organizations' views.

[1] Director, Department of Environment, Government of India, New Delhi-110011.

[2] Administrative Staff College of India, Bella Vista, Hyderabad-500475.

The Objectives of the Workshop

In the announcement for the Workshop in Environmental Management sent to Government Departments, Administrators, Industry Executives and Voluntary Organizations, the objectives were listed as follows:

1. To sensitize the policy makers about environmental consequences arising out of development projects;

2. To discuss cost-benefit analysis methodology that can be used in the case of environmental sensitive projects;

3. To highlight the managerial issues involved in environmental protection; and

4. To integrate environmental concerns in project evaluation and planning.

The objectives were kept simple so that the main purpose of orienting policymakers and make them aware of the issues and techniques of Environmental Management would not be lost.

Participation

In all, 34 participants from various organisations attended the workshop. Out of these, 2 were from the Indian Administrative Services, 4 from Indian Forest Service, 3 from voluntary organisations doing active field work on environmental improvement in hill areas, 1 from the Indian Economic Service, 2 from the power generation sector, 6 from State Water Pollution Control Boards, 1 from an Urban Development Authority, 1 from Urban Development Department, 1 from the University, 3 from companies operating Pollution Control units, 1 from a large engineering consultancy firm, and 2 from a mining organisation. These 34 were selected from 50 applicants covering variety of specialised areas. This intended heterogeneity was ensured to catalyse understanding of the interrelationships of the various areas, exchanging of the individuals' past experiences, promoting future team effort and was considered to be very vital. Such a mixed group was considered ideal to further the objectives of the programme. Further, it was the underlying motive to instill the message that environment transcends all spheres of human activity.

Motivation of the Participants

The participants attended the workshop for a variety of reasons. The following were the main aims with which the participants came to attend this workshop, as given by them in the end-of-course evaulation questionnaire.

1. To understand the major environmental issues;
2. To study how environmental problems in towns can be taken care of;
3. To understand the interaction between ecology and environment;
4. To understand how environmental degradation can be reduced;
5. To learn about cost benefit analysis;
6. To get acquainted with the latest developments in project evaluation and planning;
7. To integrate environmental concerns in planning and policy making;
8. To know how environmental impact studies can be carried out for major industrial projects;
9. To learn about cost-benefit methodologies that can be used in the case of environmentally sensitive projects;
10. To study how to achieve pollution control under the existing laws;
11. To study techniques of environmental monitoring; and
12. To meet and exchange experience with people interested in environmental protection.

It can be seen that participants differed considerably in their expectations about the objectives of the workshop. Some came to learn newer analytical skills while others were interested in an overview of the environmental concepts. Also the interest of several participants were directed towards only a part of the whole course.

Inputs

The main imputs that went into the course are given below. The faculty for the workshop were selected from different organisations. 3 speakers were from the Department of Environment, 7 from Administrative Staff College of India, 1 from Indian Institute of Science, 3 from voluntary organisations actively interested in environmental conservation. The following are the lectures or topics covered over six days.

1.	Environmental management issues in India	Lecture
2.	Technology assessment	Lecture
3.	Environmental concerns and economic development	Lecture
4.	Natural habitat	Lecture
5.	Impact analysis	Lecture
6.	Systems approach to environment management	Lecture
7.	Environmental conflicts	Exercise
8.	Environmental Management: Indian Experience	Lecture
9.	Urban environment	Lecture
10.	Environmental degradation in India	Lecture
11.	Environmental and health	Lecture
12.	Silent Valley Project--A case study	Group discussion
13.	Energy and environmental interaction	Lecture
14.	Siting decision	Lecture
15.	Economics and environmental quality	Lecture
16.	Government and pollution control	Lecture
17.	Social cost-benefit analysis	Lecture
18.	Agroforestry	Lecture
19.	Environmental conditions of India	A slide show
20.	Institutionalization of environmental concerns	Lecture
21.	Economic of resources utilization	Lecture
22.	Monitoring environmental change	Lecture

23.	Forest policy in India	Panel discussion
24.	Water quality management	Lecture
25.	Urban waste management	Lecture

Most of the sessions were of 70 minutes duration, with formal lecture for 40 minutes followed by discussion.

Participant Reactions

The participants were of the view that some more case studies should be included in future programmes. Similarly, one lecture on environmental law was also suggested for inclusion at subsequent workshops. Issues and suggestions that emerged during the workshops, were as listed below:

1. Environmental issues should be assessed at the project preparation stage itself;
2. Detailed manuals on pollution control measures for various types of industries should be prepared and made available;
3. Research on environmental protection, conservation and management must be stimulated by having a new and specialised Research Institute, under the Department of Environment;
4. The Department of Environment should maintain a data bank on environmental matters;
5. Pollution Control Boards must be more broad-based with more allocations. The current Public Health Engineering bias of the Pollution Control Boards should be eliminated;
6. Forest departments should be under the Department of Environment. Agroforestry and social forestry has to be stimulated by additional investments;
7. Legal personnel and judges must be given adequate training in dealing with the types of legal cases connected with environmental problems;
8. A series of training programmes should be organised addressing mainly to administrators and policymakers and if possible, politicians as well;

9. Middle level administrative and managers should be exposed to intensive environmental impact analysis courses;
10. Independent agencies or organisations must be promoted to carry out environmental impact analyses;
11. Industrial siting has to more rigorous, taking care of environmental degradation that can occur from the project;
12. All existing small scale industrial zones should provide pollution abatement facilities as part of their projects;
13. Whenever various agencies do not agree on a standard for pollution control, international standards should used;
14. Research and development for pollution control by biological systems, especially for city sewage, and industrial effluent treatment should be encouraged. Similarly, biological control of pests should be resorted to;
15. Specific guideline should be issued on how to assess impact of small industries especially in urban areas;
16. Water Pollution Control Boards should be technically strengthened. They should also be involved in environmental education;
17. Urban ecosystems need more careful examination and urban development authorities should develop this expertise;
18. An annual report on the State of Environment should be brought out;
19. Some of the old projects which have been completed long ago should be thoroughly studied to understand the environmental impacts they have caused;
20. Existing environmental legislation must be reviewed and strengthend so that their implementation becomes smooth;
21. Forestry requires additional investments. Diverting forests for other uses should be completely banned;
22. A statutory organisation for monitoring environmental changes and trends should be set up under the Department of Environment;
23. The Planning Commission should take care of environmental aspects before sanctioning large development projects;
24. No more deforestation must be permitted, unless each case is

examined at the highest level by a committee of environmental experts and clearance obtained;

25. Toxic chemical pollution has not been given enough attention in India and this should be dealt with adequately;
26. Considering the multidisciplinary nature of environmental management, such workshops to impact in-service training and orientation to mid-level and junior level managers are necessary;
27. The scope of such workshops should be enlarged so as to include practical and on-the-spot demonstrations of environmental degration and environmental protection measures.
28. A separate autonomous body called, Indian Council for Environmental Research and Training (ICERT) should be formed to stimulate research and training in this field;
29. More Indian documentary films on environmental concerns and issues should be prepared and screened repeatedly;
30. More universities should be involved in case study preparations on environmental protection, degradation, and conservation:

All the participants felt that they gained by attending the workshop, though to different extents. They expressed interest in attending more advanced or specific training programmes if arranged. However, one reservation, more than few had, was with respect to opportunities to apply the newly-gained insights in their own assignments. Some pains were taken by the faculty to explain how this could be done, but it is felt that it has not carried sufficient conviction.

Inferences

The author's observations and conclusions from this experience can be summarised as below:

1. A number of such interdisciplinary courses in which interaction of participants, and faculty from areas of ecology, administrative services, management, economics, sociology, forestry, environmental engineering, and so on should be conducted for various target groups at different levels. This will help attain coordinated apporach to environmental protection and conservation;
2. Engineering and Management courses should offer at least one

course on Environmental Management;

3. Commercially oriented organisations like electricity boards, paper mills, etc are still rather reluctant to adopt environmental control measures, as judged by the interventions of participants representing these interests;

4. Senior government administrators are more flexible in their approach to environmental conservation and they are in general conceptually able to accept the need for environmental protection. However, they find themselves trapped by long practised and archaic systems and unable to reform, all of a sudden existing procedures, lest they be accused of retarding the progress of development;

5. Participants were inclined to view environmental issues from their own narrow angle of vision and they were reluctant to step into realms outside their own specialities. However, towards the end of the course, inhibitions were down enough for the urban development expert to speak intelligently and feelingly about forestry, or the pollution expert view compassionately at wild life protection;

6. It was observed that sharing of experience is better when the group is multifunctional. The heterogeneity of the participants was a positive factor which introduced various viewpoints for discussion. This has been one of the basic strengths of the approach adopted;

7. Undoubtedly, there is an urgent need not only to continue to organise similar workshop at the ASCI, but also in different regions of the country in association with management, development, adminstrative, technical, economics education centres;

8. Voluntary agencies geared to the task of environmental protection have to be organized and encouraged in all ways in order to arouse the consciousness of the public and motivate them to participate in environmental action programmes. The Department of Environment should serve as a model agency for such voluntary groups and guide them in establishing worthwhile action programmes.

Follow-up

As a result of the useful experience from this workshop, the Department of Environment has decided to organise a series of such Training Workshops in Environmental Management at the Administrative Staff College of India. Each Workshop of a general nature for a heterogeneous group of participants will alternate with more intensive area-specific workshop for target groups like industrial managers, forest service officers, dam design and construction engineers, town planners, pollution control engineers, rural development specialists and so on. This programme series is set to start from early 1982.

Identification of Psychological, Cultural and Physical Materials for Environment Education

BISWANATH RAO*

Introduction

It is a truth that no one lives in vacuum. A person is always surrounded by a three dimensional environment consisting of psychological, cultural and physical conditions. The psychological conditions are personal to the individual, the cultural conditions are the products of his mobility for his social expansion and the physical conditions are always natural to him. In case of failure of any of the three, there will not remain any choice regarding life styles and behaviour of the individual to maintain a socialy useful, productive and supportive ecosystem good for all. On the other hand, if the three together work well, then there can be happiness in living and efficiency in working.

The objective of the paper is to identify such psychological, cultural and physical conditions which can serve as effective input materials for an effective environment education (EEE). These materials can be, in turn, be used in the development of training and curriculum programmes. This will be possible, if we look into education from the systems point of view and specially as a transformation process. This is a process and can be placed in the following way:

Input	*Transformation process*	*Output*
1	2	3
1. That which is transformed: *Children*	Education (Environment Edn.)	Socialized, Self-actualizing, Skilled young adults

---

*Reader in Psychology, Educational Psychology Unit, N.C.E.R.T., New Delhi.

1	2	3
2. That which does the transforming: (a) Curriculum (b) Personnel (c) Books (d) Teaching aids (e) Learming aids, etc.	(a) Psychological (b) Cultural (c) Physical	

Environment education will be a part of the curriculum, to serve as a transformation process. The kind of output (in specific) is, to make the children more aware, alert and active about the conservation of the self, the culture and the nature. These three, will now be discussed from psychological, cultural and physical point of views.

Psychological Materials

The psychological materials are principally associated with the overt behaviour of the person and its covert reasons as associated with motivational aspects. Studies on life-styles and behaviours of individuals, are helpful in discovering the psychological environment in which the individual lives. This is necessary for purposes of adjustments for an effective living. Adjustments are possible through development of tolerance and other psychological defences.

We know from our experiences that, through behaviour analysis, three types of behaviour styles (in opposites) can be visualized. These are: indirect-direct, initiative-responsive, reinforcer (positive and negative). But no behaviour can operate in isolation or in vacuum. Every behaviour takes place in a 3 x 3 x 3 matrix situation. It is like the following:

Situations (1)	*Mental Operations* (2)	*Behaviour styles* (3)
Temporal	Topography	Direct-Indirect
Spatial	Dynamics	Initiative-Responsive
Individual	Economy	Reinforcer (Positive and Negative)

The objective of finding out the psychological aspects is to induce attitude and behaviour changes for an integrated personality development. This is required for tension reduction and adjustment purposes with others. Klopfer and Devidson (1962) had considered certain psychological aspects in the following manner:

1. *Cognitive, or Intellectual Aspects*
    - 1.1. Intellectual status and functioning
    - 1.2. Manner of approach
    - 1.3. Power of observation
    - 1.4. Originality of thinking
    - 1.5. Productivity
    - 1.6. Breadth of interest.
2. *Affective, or Emotional Aspects*
    - 2.1. General emotional tone
    - 2.2. Feelings about self
    - 2.3. Responsiveness to people
    - 2.4. Reaction to emotional stress
    - 2.5. Control of emotional impulses.
3. *Aspects of Ego-Functioning*
    - 3.1. Ego strength
    - 3.2. Conflict areas
    - 3.3. Defences

The above fourteen aspects (6+5+3) under three broad headings needed to be translated into actual visible overt behaviours or behaviour styles, so that they could be actually seen under visible terms.

The overt behaviours will express the ego-functioning in visible forms. The purpose of such ego-functioning is to develop an integrated personality in the individual, reduce intra-psychic gap and thus help him to put up effective struggle to solve the twin problems of survival and growth in his own environment. The following 20 behaviour styles may serve the purpose of *behaviour development* as a part of environment education.

Behaviour Styles:

1. Enjoys funny remarks made by others.
2. Praises what others say in any discussion.
3. Tells others about interesting matters for reading.
4. Influences others towards his own orientation.
5. Suggests others new and helpful ways of living.
6. Talks with others about any idea they have.
7. Organizes groups to undertake work together.
8. Shows others how to look up for an answer when they are unable to find it themselves.
9. Discusses with others about how the tomorrow should be planned.
10. Acts disappointed when somebody does something wrong.
11. Asks others what they think of something a person has said.
12. Modifying his attraction towards others, i.e., liking them less.
13. Supports his views with examples from day to day life.
14. Cordially greets any new person.
15. Cares friendship among all.
16. Behaves equally with everybody.
17. Takes up Seriously and does everything to restore the efficiency of others.
18. Insists upon the doing of domestic responsibilities.
19. Keeps in touch with progressive ideas.
20. Helps others to go up by themselves.

The above behaviour styles as psychological materials and as a proposed part of Effective Environment Education (EEE) curriculum have to serve certain motivational aspects as well. The motivational aspects can be classified as below:

1. Orientation of needs, moods, desires, wishes.
2. Overcoming of fears, anxieties, stresses.
3. Fulfilment of ambitions and hopes.

4. Build up friendship and cooperation.
5. Minimize enemities and rivalry.

The above can be achieved by making the behaviour styles as psychological materials and as a part of the EE Curriculum. The objective of these motivational aspects is to make the child creative, field independent, need oriented, goal directed and develop a reality sense. These can be achieved through behaviour training programmes through behaviour modification and behaviour change.

Cultural Materials

Culture can be broadly defined as *a way of life and living* which remains very much unchanged irrespective of place and time but related to either the person or a group of persons. The kind of the *way of life and living* is known as cultural identity. There can be a micro-culture (or, closed society) and macroculture (or, open society) also, based mainly upon the dimensions of closed vs. openmindedness, fatalism vs. scientific attitude and egoism vs. altruism. However, in a balanced pluralistic society both the extremes of the alternatives remain operative having varying degrees of emphasis. The basic psychological dimensions which are operative over here are: (1) a reasonable compromise, (2) increase in tolerance. This has created cultural overlapping, although separate cultural identities also remained in the *culture-spectrum.* Under this, cultural materials can be distinguished in the following ways:

1. *Performing Arts*:
    1.1. Drawings, paintings, sculptures and objects of fine art
    1.2. Styles of music at different places
    1.3. Styles of dances and dramatics at different places
2. Philately
3. Physical appearance
4. Religions, Religious beliefs, attitudes and prectices
5. Food habits
6. Dresses
7. Languages: spoken and written
8. Methods of survival and growth

The school going learner can be exposed to the above, so as to expose the learner to the cultural environment around him. The above materials will educate the school going learner, about his cultural habitat.

Physical Materials

The physical environment as it stands today over the interaction between population growth, food supply, capital investment, geographical space, pollution and resource depletion, has created an anxiety prone society which intends to grab anything. Such distortions have reduced the ego-strength, confused the ego-identity and has brought the innerself on the verge of destruction. This forewarns about the impact of devouring of our heritage (fuels, etc.), effect of rapid urbanization and environment pollution and thus creation of a *lethal society* or a *death dedicated society*.

The problem of factory-waste supports this view. The workers and the community are exposed to more health and life risks through environment pollution. The pollution leads toward heart and lung diseases likes asthama, tuberculosis, rise and fall in blood pressure, creation of hypertension which all lead toward reduction in age and health. Problems with the nuclear waste, radio-activity, have been fatal.

The above is a part of the work-dimension of the society. This can be seen in two ways (Lonsdale, 1964):

Work Dimension
- (1) Task-achievement dimension/nomothetic (or, institutional)
- (2) Need-satisfaction dimension/ideographic (or, individual)

The No. (1) above constitutes the physical environment and can be put under the following sub-heads:

1. *Physical materials*
    - 1.1. Temperature, air-movement, humidity, ventilation
    - 1.2. Illumination, artificial and natural lighting
    - 1.3. Noise and vibration
    - 1.4. Smell

1.5. Work study, lassitude, discomfort

1.6. Muscular and mental fatigue

1.7. Sanitation problems.

Conclusion

A major objective of environment education should be to reduce the degree of uncertainty in life and living. Three concepts are associated with this. They are: mental health, cultural health and physical health which are combined to create a congenial environment for effective and creative functioning of the human resource potential and its optimum utilisation. In this way, there can be a build up of the autonomous and integrated society. Thus, there should be a framework of environment education for the development of the individual through a culture bound quality in life and value, free from arbitrariness. Prevailing knowledge versus long term knowledge related to time, life and energy give a meaning to value. The message is that, life in any form is precious and needs optimum care for preservation and utilisation to develop an autonomous and integrated society.

References

1. Klopfer, B. and Davidson, H.H. *The Rorschach Technique. An Introductory Manual.* New York: Harcourt Brace Jovanovich, Inc., 1962.
2. Lonsdale, *R.C. Maintaining the organisation in dynamic equilibrium.* In D. Griffiths (Ed.) *Behavioural Science and Educational Administration. 63rd Yr. Bk. of N.S.S.E., Pt. II,* University of Chicago Press, 1964 (p. 166).

A Proposal for Mass Education of Environment

RAJNI VARMA and R.R. DAS*

Human population today is at exponential phase of its growth resulting in a phenomenal increase in the number of human beings. The phenomenal increase of human beings and limited resources at its command has created a situation which threatens the existence of man himself. The realisation of this fact has lead proper to put all their efforts to control the population growth. Along with this it has also been essential to bring under control the deterioration of the environment caused due to unwise use of the resources.

A section of educated people have become conscious regarding the problems of environment in the offing. But for solving this problem it is essential that general masses be apprised of the problem and only through their efforts some fruitful result could be obtained.

India having a large population and limited resources has a great proportion of illiterate persons. It is all the more difficult to impart education to such populations towards the problems of environment. It is also essential that a general awareness is generated amongst masses so that the environment is treated well and not allowed to get further deterioration. This is the problem of the masses and hence a handful knowledgeable persons cannot solve the problem to the extent. needed.

Environmental education is an important and vital activity for harnessing a prosperous and flourishing society. Various mass media has to be applied to achieve this objective. It must, however, be realised that these mass media be oriented in such a way that they act as social carriers of technological innovations and ideas together with the proper environmental aspects associated with the same.

In order to arouse proper awareness towards our environment various mass media be utilized to bring out a sustained and systematic

---

*School of Studies in Botany, Jiwaji University, Gwalior.

programme of environmental education. To achieve this mass media of instructions like radio, newpapers and periodicals, television, cinema and posters be utilized.

The preparation of these materials requires the assistance of an expert environmentalist. It is here that a handful of environmentalists can help in creating and innovating the ideas to be distributed to general masses through various media. The general mode through which this can be achieved is outlined herewith.

The Approach

The principal objective of the utilization of these mass media for the environmental education should be to present systematically various aspects of environmental problems and their solutions. The emphasis must also be laid upon the role of individuals to protect the environment. It would thus be essential to prepare programmes and publishable materials indicating the problems faced at different localities, their causes and possible methods of control. In all these programmes clear indication be made regarding the role of the individuals in the abatement of the environmental problem.

A panel discussion on the media and its impact organised by the ladies study group of the Indian Chamber of Commerce (Industrial News Digest, 1981) revealed that about 46 percent ofthe adult population and 90 percent of the total population listen to the radio. Nearly 500 lakhs of radio sets are used in the country. This is used by Gram Panchayats which a large number of villagers listen.

Another important medium to dessiminate the knowldge could be cinema. Nearly 36,000 lakh people see films per year in 12000 cinema halls in India. Short feature films depicting environmental problems and their abatements be exhibited along with news reels. The audiovisual depiction of the problem can be most successful method for educating the masses especially the illiterate persons.

Newspapers and other periodicals can serve as a very effective medium for exposing the problems of the environment to literate persons. The survey made with regards to the number of persons reading the newspapers and magazines is limited to only 4 crores out of the total Indian population of 68.3 crores. In all about 15,000 newspapers and magazines, published in India. The reservation of some columns in these for the materials on environmental problems and awareness is bound to arouse genuine interest in the people at large.

Radio

Weekly broadcasts be arranged from A.I.R. figuring various aspects of environmental problems in forms of features, interviews from the experts, panel reports etc. The coverage should be such that it covers wide range of local environmental problems, their solutions and the role of the people in avoiding the deterioration of the environment. Panel discussions with the experts must also be arranged so that opportunity be provided to general people to confer on these problems with the experts.

The matter be prepared in such a manner that the basic problems be clearly brought out. Such series be prepared to suit the requirements of various strata of the society. This again needs careful and devoted efforts of expert environmentalists. The key points may be repeated a number of times to ensure that it is well assimilated by the masses. The effort should be made to make the matter lucid, interesting and full of approaches.

The listeners shall be invited to send their questions and comments. The arrangements be made to broadcast during subsequent programmes the answers to questions and comments of the listeners.

Some of the important aspects of environmental problems on which programmes can be organised as listed below:

1. Environment problems and perspectives
2. The population explosion
3. Energy crisis
4. Impact of man on environment
5. Environmental conservation
6. Development and environment
7. Environmental management
8. Environmental Pollution—cause and effects.

Television

To make an effective contribution towards improving the environment, educational action must be linked with television. Certain features and documentaries pertaining to various facets of the environmental problems and their protection be made a regular feature of the television programmes. As incentives to produce better features and documentaries on these aspects the prizes be announced for good productions. Some figures and for features which clearly depict environmental hazards be telecasted between two scheduled programmes.

Newspapers

To achieve the effective development of environmental education, full advantage must be taken of newspapers. Following are certain recommendations which may be followed to spread effectively the environmental awareness amongst the masses. Newspapers be instructed to play a more active role in the development of environmental awareness amongst people. Adequate and pertinent matter on problems of environment, environmental degradation, environmental protection and planning must be published by each newspaper and magazine. For this purpose in each issue a certain space be earmarked and that must be utilized for this purpose. The publication of photographs, cartoons, flow diagrams, graphs, etc. depicting various aspects of environmental degradation and hazards caused due to them must be published.

The newspapers and other periodicals be instructed to highlight the conclusions drawn by the seminars and conferences held on environmental problems. They may be initiated to take up the follow up programmes by arousing public awareness. It is through such efforts that the environmental conscience can be developed amongst people at large, which will help in improving the quality of environment.

Cinema

One of the basic aim of environmental education is clearly to show the economic, political and ecological interdependence of the modern world. Documentaries and feature films produced depicting these aspects must be shown to apprise the people of the problems of environment, the extent of damage already done and possible methods of its care. These must depict the duty of each human being towards the protection of the environment. Such features will arouse a sense of responsibility and thus help in protection of the environment. Thus through such shows, the cinema is bound to foster clear awareness of economic, social, political and ecological interdependence in urban and rural areas. It will also provide opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment and to create new patterns of behaviour of individuals, groups and society as a whole towards the environment.

Posters and Banners

People of all ages and socio-professional groups have to be exposed to the problems of the environment. People of all ages and socio-professional groups come to public places while they are going to schools, offices, market, etc. They also have to take long distance travel in connection with their socio-professional activities. In case well designed and properly worded posters are placed at prominent public places, e g. along roads, in city, national and state high ways, bus stands, railway platforms, parks, picnic spots and the like places. It will serve to introduce to a larger population the awareness and our duties towards achieving a healthier environment for our happier living.

Strategies for Using Extra-Curricular Activities in Science for Spread of Environmental Education

SHAKUNTALA BHATTACHARYA*

All possible modes of education about the environment and its conservation should be attempted in order to achieve significant results within a short period. Extra-curricular activities in science may help to create an awareness of environmental problems and facilitate their solution, both amongst the school and the community at large and school going children in particular. The two major forms of extra-curricular activities that has gained ground in the last few decades are the science-clubs and science exhibitions. The possibilities of using these as means of spreading environmental education needs serious attention.

Science Clubs

Science clubs are not a new phenomena, though school science clubs are of fairly recent origin. As the name implies these are gathering of like minded people (clubs) working on scientific projects—hence science clubs. The establishment of science clubs in schools was spearheaded by the Extension Programmes Unit under Ministry of Education in 1957. During the period 1963-66 NCERT organised a number of workshops for science clubs sponsors. Funds to the tune of Rs. 1,200 was made available to a school for establishment of science clubs. About 2,000 hundred schools and teacher training colleges availed of this opportunity to establish science clubs. To further the cause, NCERT brought out a small booklet called 'Organising Science Clubs' in 1965. Due to various reasons further funding of science clubs was stopped, but NCERT continued to give advice on how to run such clubs.

This effort in the early sixties acted as a catalyst and the latest

---

*DESM, NCERT, New Delhi-110016.

education survey reveals that about 10,000 science clubs are presently running in schools. Some of these science clubs are very active. The majority, however, are in the doldrums, coming out of it for short periods when exhibitions are put up during the annual school functions. Thus there exists in this country an established forum, which judiciously used, could form a base for spreading environmental education.

Science clubs were established and are being established to complement the formal science education system. Hemmed in by prescribed curricula, examinations which demand no high degree of intellectual activity, and the pressure of doing well in examinations to take up lucrative careers the child loses his natural sense of inquiry, his curiosity and his enthusiasm for exploring his environment, and in the process his creativity is dampened.

Science clubs, it was thought, would give the child, scope for his creativity. It would encourage him to become aware of his environment and the problems that exist within it, and make him attempt to solve it in a logical manner, or in other words would encourage the development of scientific attitude. However, said to day, most science clubs set up in schools, do not have sustained activities through the year and hence contribute little to the creation of environmental awareness and scientific temper.

To achieve the ends outlined above, activities of the science clubs should be well-planned. The plan should cater to a variety of activities and not be confined to model building only. Such activities should include—science film shows, seminars, popular science lectures, exhibitions, science newspapers and above all long term projects related to problems of the immediate environment. Membership of such a clubs should be open to all students and teachers of the school. Besides, members of the community such as doctors, engineers, craftsmen, agricultural and health officers should be requested to participate in the programmes. Activities such film shows, popular lectures, exhibitions should be open to the public. This would ensure to a certain degree of the involvement and participation of the community.

What are the type of environment-based projects could a science clubs take up. First, of course, is the identification of the problem. In most areas certain specific problems of health, nutrition and sanitation exist, others might be deforestation or pollution. The next step would be to make a proper survey of the existing situation. This should be a group activity. Once the findings of the survey are compiled, then the solution to the problem should be sought, For instance, if a particular nutrition deficiency is observed in the diet pattern of the community, the next step would be explore the possibility of overcoming this deficiency, not by a complete change of diet, but by the addition of something which is easily available in the area. One might argue that such problems are too tough for children, or for that matter for the average science teacher. This is where community participation can play an important role. There are informed people—doctors, health workers, agricultural officers—who will be able to supply the required guidance and information. It is for the science clubs to make an attempt to interest these persons in their activities. Science clubs could also take up pioneering activities in the introduction of new modes of livelihood in the area—poultry keeping, apiculture, pisciculture sericulture to mention a few.

Once the problem and its solution is known and understood by the members, it should take up programmes of spreading these within the community. This can be through various means—popular lectures, demonstrations, film-shows, posters competitions, exhibitions, etc. One particular point comes to mind at this stage—science clubs should not restrict its membership to only those who are fond of practical work, building models and working on projects. It should also encourage those children who have the knack of communication—through lectures, writings and drawing. They should be encouraged to build a bridge between the clubs and the community to facilitate the spread of environmental education. One particular activity which would be highly innovative as well as entertaining is to present the environmental problems and their solution through plays and puppetry staged by club members.

Science Exhibitions

Science exhibitions too are becoming a part of the school education scene. For the last ten years NCERT has been sponsoring the National Science Exhibition for children. Besides it also provides a certain amount of funds for organisation of State Level Science Exhibitions. The states in their turn sponsor block and district level exhibitions. Many school organise science exhibitions during their annual day functions. Thus science exhibitions have percolated down to the grass root level—and millions of viewers all over India have a glimpse of scientific achievements, through the efforts of the children.

The potentiality of using this media for spread of environmental education has not been left unexplored. For the last few years NCERT has been focussing on themes—for instance this year's National Science Exhibition for children, held at Bangalore had as its theme "Science in our Environment" with such sub-themes as 'Energy Generation and Needs', 'Town and Village planning', 'Health' etc. Such themes were designed to draw the attention of the participants and viewers to the problems of the environment and their solution. It is hoped that through this means they have been able to create a little more awareness about the environment and its conservation. The themes have generally focussed on a wide vista, but the time is fast approaching when the focus will have to be sharpened to a particular area—the range of a sub-theme—to make the exhibitions more meaningful in its educational aspect. The exhibitions should also be coupled with films, lecture and seminars on the same theme to add to its impact.

Science exhibitions have also been mentioned as an activity for science clubs. They could form base for celebration of World Envrionment Day or World Health Day programmes. This would draw attention of the public to the ideas which these days promulgate.

Problems of Implementation

While there can be no doubt that extra-curricular activities in science can help the spread of environmental education, problems of its implementation are two-fold.

1. Firstly, educationists, and particularly those in authority must be convinced enough to provide the necessary infra-structure for proper organisation of science clubs. This means providing space, periods on the timetable, and encouragement to teachers for organising such activities. The school is an intergral part of community and it is imperative that they play their part in community development through environmental education with the active help of the people of the locality. The exchange should be two-way—the school club gaining from the knowledgeable community members, and passing on the knowledge gained to the masses. This can only take place if the authorities realize the importance of science clubs in the spread of environmental education.

2. Secondly, the problem of funding and providing guidelines for the popularisation of science in general and environmental education in particular. The government at both Central and

State levels have departments which could cater to these needs. Department of Science & Technology, Department of Environment, Department of Rural Development all have funds and manpower which would if properly channelised and utitized, provide sufficient impetus for the extra-curricular science activities to play an important role in the dissemination of environmental education.

Gujarat's Nature Education Programme

M.A. RASHID*

Introduction

Despite the fact that killing of animals is abhorrent to the average Gujarati and sport hunting in any form is generally frowned upon, the unique wildlife of the State has nevertheless been sadly depleted in recent decades. The tremendous pressure on our land, fuel and fodder resources has further exerted a detrimental influence on wilderness areas. This paradox is explained by the fact that the general public in Gujarat is not aware of and apathetic to the dangers by which all plant and animal life in the State is threatened. The populace, particularly in the rural areas, is so hard pressed for its daily requirements that there is no inclination to take one more concern to add to its burdens. The urban population, on the other hand, is generally too far removed from forests and wild life to be actively exercised about their denudation and depletion. Whenever this problem does come up for discussion, as often as not, the response is an indifferent shrug of the shoulders—wild life to them is of secondary concern.

The prevailing climate of ignorance and public apathy has taken a devastating toll of our forests and wild life, particularly in the post-independence era. As our development plans gained momentum, forest habitats were indiscriminately exploited for a variety of purposes, such as extension of agriculture, construction of hydel projects, mining and quarrying, and a host of other competitive forms of land use, with the result that several species of wild flora and fauna were persecuted to the point of virtual extinction. Gujarat today has a bare 10 percent of its land area under forest cover, as against the optimum of 33 percent stipulated in the National Forest Policy.

The Programme

If this disastrous trend to be halted and reversed and an active public opinion built up in favour of the conservation of forests and wild life, we have to make a start with the younger generation. To attain this goal, we in Gujarat have launched a vigorous programme of nature, education, initially meant for lower and higher secondary school children, with the active collaboration of WWF—India. This programme is being built up around the nucleus of a Nature Education Sanctuary (probably the first of its kind in this country) located in sylvan surroundings at Hingolgadh in Rajkot district, with a charming medieval castle belonging to the Durbar Saheb of Jasdan perched on a hillock affording a commanding view of the enchanting sanctuary landscape. This nature education programme was initiated in 1975 by Mr. Lavkumar Khachar, a retired school master of the Rajkumar College, Rajkot, and a leading conservationist of Gujarat, under the auspices of the Saurashtra Branch of WWF—India. As this programme was suffering from financial constraints, I decided to associate my department with it from 1977 with a modest official grant of Rs. 35,000 made available by the State Government. Since then, this programme has gained increasing momentum from year to year. Considering the enthusiastic response it has evoked and the spectacular success it has achieved, the State Govt. have magnanimously increased their financial involvement to Rs. 1.50 lakhs this year and have earmarked a budget Rs. 3.75 lakhs for it during the year 1982-83. WWF—India also contributes its own finances for this programme to supplement the departmental grant.

---

*Special Chief Conservator of Forests, Wild Life, Gujarat State, Vadodara.

The programme content includes a couple of day's camp in the outdoors in an informal atmosphere and exposing the participating school children to various aspects of nature and its conservation under the supervision of knowledgable guides drawn from the Forest Department and volunteer members of WWF—India under the leadership of Mr. Khachar. Participants only pay for their transport to and from the place of camp, while their boarding and lodging expenses are borne by the Forest Department. The Bombay Natural History Society has also been associated with winter camps by organizing bird banding programmes around Hingolgadh which falls on the bird migration route. Attractive certificates are issued to all participants attending the camps. Such camps are held during term time, i.e., in August-September at Hingolgadh, in December on Pirotan Island and in February in the Gir Lion Sanctuary.

So far nearly 3,000 children have benefited from this programme. From this year, we have established new nature education centres on the same lines at Gandhinagar and around Baroda to cater for school children of Central and South Gujarat.

We are indeed happy to assert that our nature education programme has the finest conceptual format and educational experience anywhere in the country. It has above all resulted in active and fruitful collaboration between the Forest Department and amateur naturalists and conservationists in a field where, more often than not, there is considerable rancour and suspicion in most others States.

Thus what started as a dedicated retired school master's dream has now blossomed into a flourishing nature education programme which we hope and trust will prove to be a pioneering venture of its kind in this country. It is also a shining example of symbiotic relationship between a Goverment Department and a voluntary organisation which are both working for a common cause.

Programme Constraints

Our experience thus far has shown that we shall have no dearth of participants. However, we are cautiously hesitant to broaden the area of recruitment lest the programme get diluted into an impesonal exercise, thereby losing the intensity of its impact on the one hand and the obvious hazard of throwing open our sanctuaries to the undisciplined numbers who might join such camps merely for the sake of an outing or out of sheer curiosity. This has to be strictly guarded against.

Perhaps the single most crippling constraint on the expansion of this programme is the lack of suitable personnel capable of conducting such camps in an effective manner. It has been found that teachers by and large are totally lacking in the type of intellectual perceptions and educational experience of this nature requires. A special programme for training up such teachers is, therefore, urgently called for. This deficiency can also be partly made up by preparing pictorial exhibits and educative illustrated booklets, use of audio-visual equipment and laying out self-guided nature trails in the camping areas which can encourage children to discover things for themselves.

With a wealth and variety of easily observable bird life on Pirotan Island, for instance, the need for several highpowered viewing telescopes is acutely felt. In fact, an almost classroom situation of having a variety of bird species right in front of the young observers cannot be adequately exploited due to this handicap.

Outlook for the Future

It is proposed to build up the necessary infrastructure at all the selected camping sites, such as construction of barracks, purchase of tents and camping equipment, provision of boats, viewing telescopes and binoculars, slide and film projectors, bird banding equipment, etc. It is also planned to bring out on a continuing basis a series of popular illustrated booklets on plants, animals, birds and reptiles, as also on conservation topics, together with slide audio-visuals based on these as educational aids. Any assistance forthcoming in procuring such material from international organisations such as UNESCO, IUCN, WWF, etc. would be welcomed.

A "Reptiles Go To School" unit is in the process of being put together with assistance from WWF—India and it is hoped to arrange special one-day programmes in member schools where children will be allowed to see and handle live reptiles. This new teaching concept will be followed by others involving other forms of animal and plant life. Field courses on astronomy and geology are also being evolved.

Self-guided nature trails are proposed to be laid out in the Hingolgadh and Gir Lion Sanctuaries. Nature orientation centres are also being set up in all our major Sanctuaries and National Parks for educating visitors.

In view of the steady expansion of the nature education programme, the State Government have been requested to create the post of a full time grade I Nature Education Officer who will plan and coordinate this programme throughout the State. This post is expected to be sanctioned under me this year.

The year 1982 is going to be an important milestone for the entire nature education movement in Gujarat and the action taken during this year will greatly influence the future of this movement and our achievements in the crcucial years ahead.

School Nurseries

I would like to make a pointed reference to another novel experiment of raising "school nurseries" through the agency of school children, particularly in the rural areas, under the massive social forestry programme costing Rs. 65 crores which the Gujarat Forest Department has launched from April, 1980, with assistance from the World Bank. Under this scheme, school children are encouraged to raise and nurture tree seedlings in polythene bags which the Department later purchases from them on payment at the rate of 15 paise per seedling to supplement the Department's own stock of seedlings raised for the annual Vana

Mahotsava campaign for which the current target is a staggering 15 crores seedlings. Seeds, polythene bags and necessary technical guidance for this purpose are provided to the children by the extension staff of the Deptt. Apart from fetching them handsome monetary returns, this popular scheme inculcates in the children a love for trees and a proud sense of creative achievement. Hundreds of schools in Gujarat have already joined this movement which is gaining rapid momentum from year to year.

Newspaper's Role in Educating the Mass on Environmental Issues in India

T. SEKAR*

Introduction

In the present-day world, the need to create public consciousness and greater mass concern on the issues of human environment has become vital. Nicholas Polumin, a noted conservationist, stated: "Enlightened understanding by man of his environment is a prerequisite to saving it". Of late, there has been growing emphasis on the relevance of environmental education programmes to provide an insight among the people of the economic, political and ecological interdependence. The mass media have to play a prominent role in fostering awareness among the masses. The present study is an attempt to evaluate the role of Indian newspapers in educating the people of their environment and in inculcating a sense of involvement in the issues of environment.

Mass Media in India

Various means of mass communication aim at instructing, educating and entertaining people in various ways on different aspects. Radio comes first among the mass media, reaching people of all socio-economic strata. With 84 stations spread over the country, All India Radio (AIR) covers nearly 90 per cent of the population. Television serves about 15 per cent of the population[1]. The other influential medium is films, claiming a weekly attendance of about 30 million[2]. The Press with its several thousand newspapers published in English and Indian languages suffers from an obvious setback because of its limited circulation. Figures on the total number and circulation of newspapers are presented in Table 1[1]. Indian press could only serve as a less potential communicating medium because of its significantly lower readership, which is below ten per cent of the total population. The unsuccesful role of Indian newspapers in fostering mass interest on crucial environmental issues is also because of the heterogenous nature of the readers and lack of

---

*School of Environmental Sciences, Jawaharlal Nehru University, New Delhi.

TABLE I

Number and Circulation of English and Indian Language Newspapers during 1978

Details	*1978*	*Percentage of total newspapers and circulation*
Number of Newspapers:		
Total	15,814	100
English	3,085	19.5
Indian languages	12,729	80.5
Total circulation (in '000)	40,850	100
English	9,030	22.9
Indian languages	31,820	77.1

systematic reporting of authentic environmental information[2]. Moreover, the masses are much occupied with basic needs like food, clothing and shelter and for them environmental problems often have a low priority.

Content Analysis and Opinion Survey

Quantitative information on the newspaper coverage of environmental issues was obtained by analysing the contents of three national dailies. The hindu (Madras), The Hindustan Times (New Delhi) and The Times of India (New Delhi). The articles, editorials and news items on environmental issues appeared during January 1979 to April 1980 were collected to elicit empirical information on the newspaper coverage. The items were grouped into the following categories.

1. Population growth and food grain problems,
2. Energy crisis and new sources of energy,
3. Environmental conservation, and
4. Environmental Pollution.

The frequency of publication of specific issues like the proposed

Mathura Refinery's threat to Taj Mahal and the impact of hydro-electric power project on Silent Valley tropical rain forests were also recorded.

Questionnaires were given to university students pursuing graduate and post-graduate studies in various disciplines of sciences and humanities in consolidating their opinion on the role of Indian Press in making the masses aware of environmental issues and creating public concern. The completed ones were collected and later analysed.

News aper Coverage on Environmental Issues

Data on the total items published on environmental issues in two English dailies are presented in Figure 1. It is evident that these dailies

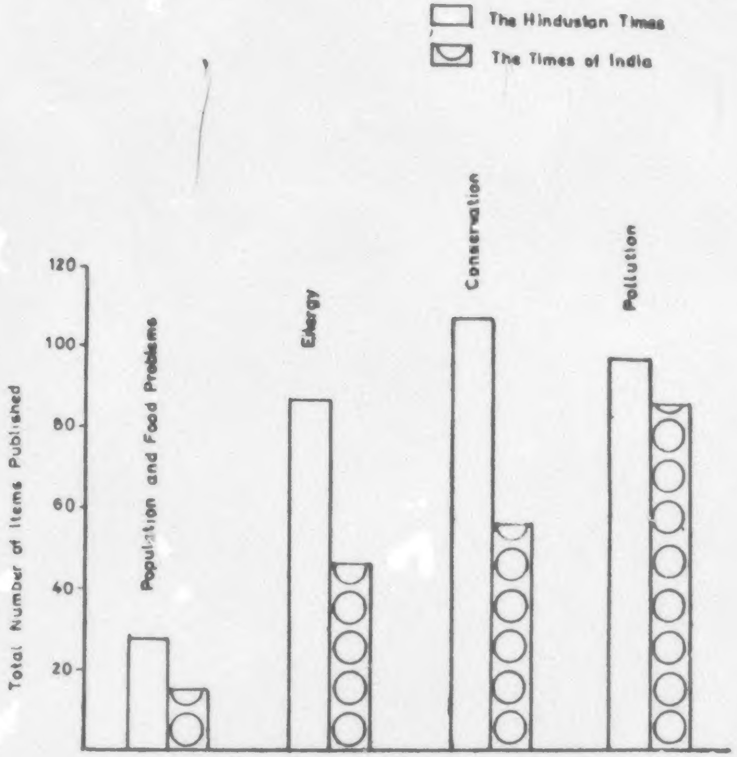


FIG I NEWSPAPER COVERAGE ON ENVIRONMENTAL ISSUES (JAN 1979 - APRIL 80)

with a large circulation (Table I) bring out reports, articles and editorials on various environmental problems of local, national and international significance. Analysis of the contents further revealed that a wider coverage and greater emphasis were given to water and air pollution problems, conservation of nature and maintenance of ecological balance. Frequent coverage was given to more specific issues like current trends in solar energy utilisation, nuclear wastes disposal, and Silent Valley (Table II).

TABLE II

Coverage on Specific Environmental Issues

Newspaper	*Specific issues published (Jan. 76—April, 80)*		
	*Solar Energy***	*Silent Valley*	*Nuclear wastes*
The Hindustan Times	22(25.2)*	39(36.4)	21(24.4)
The Times of India	19(41.3)	22(39.3)	21(21.6)

*Figures in parenthesis are percentage of the total items appeared on the respective categories.

**Solar energy is grouped under energy crisis, silent valley under conservation and nuclear wastes in pollution.

The trend in publication of two specific issues, observed a gradual increase from a low initial rate (Figure 2). Both the examples represent sensitive and controversial projects, the implemention of which are argued to have serious and irretrivable consequences on Taj Mahal and Silent Valley tropical rain forests, respectively. A critical perusal of the published material led to the following conclusions:

(i) There was a general interest in the reporting of these issues which gradually increased in intensity with time. The frequency of publication was at its maximum when the fears and predictions of scientists including environmentalists and conservationists (in the interest of safeguarding the environment) contravened the claims and assurance (for remedial measures) from governments who were in favour of these projects.

(ii) A slump in the emphasis on these issues, especially on Taj Mahal was followed by the concerned minister's announcement

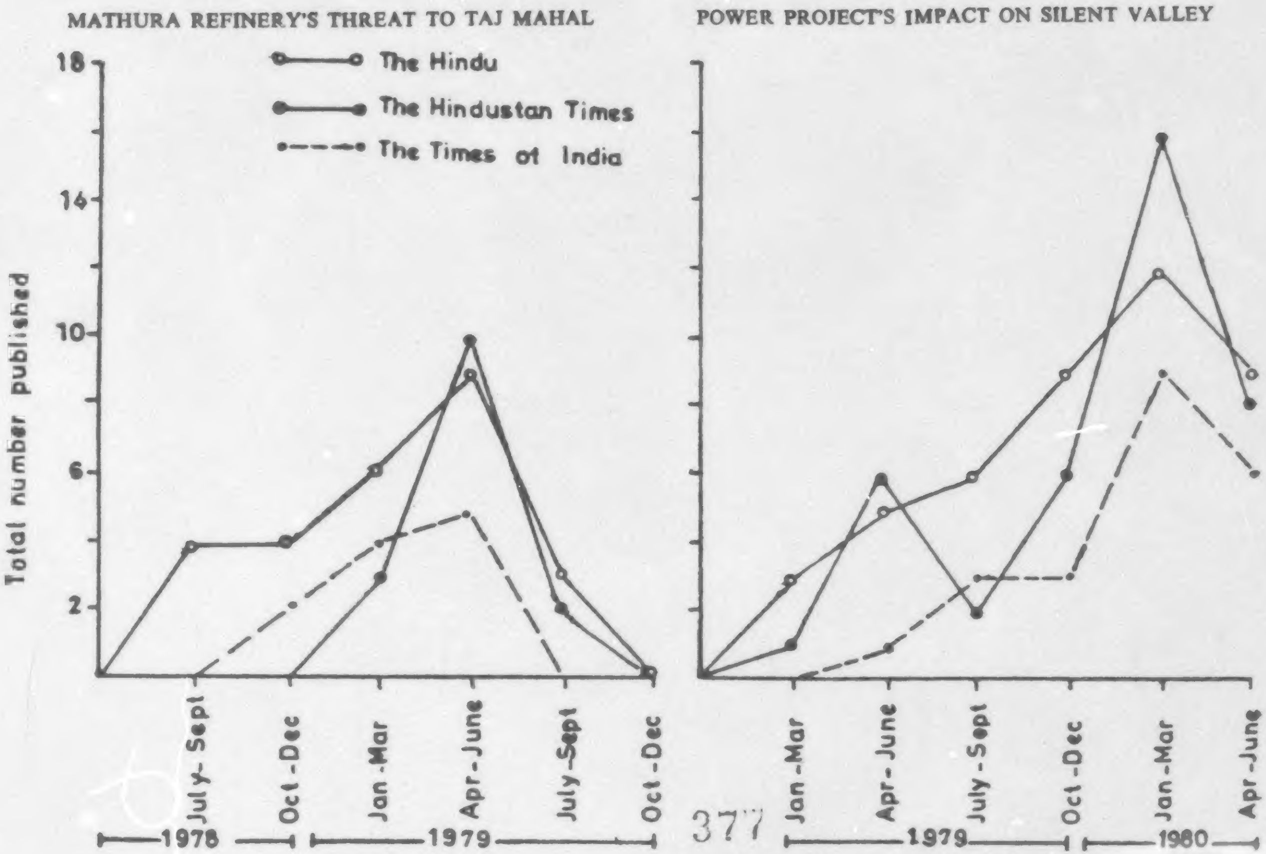


Fig. 2 NEWSPAPBR COVERAGE ON SPECIFIC ENVIRONMENTAL PROBLEMS

that locating the refinery project at Mathura need not be examined further, with his subsequent assurance for installing adequate air and water pollution control equipments to contain the dangers of its pollutants to the monument. In the case of Silent Valley a decline has been observed following the Central Government announcement that a team of experts and scientists has been set up by the Centre, who will stay in the Silent Valley and make a thorough study on the basis of which the future of the power project will be decided (The Hindustan Times, 21-4-80).

(iii) Except for a few informative articles and editorials, the rest of the items lacked an in-depth approach to the problem and they tended the serve only as a newspapers report.

Further categorisation of the items on Silent Valley into news items, editorials and articles proved the failure of these newspapers to present, aggressive and investigatory reporting (Table III). Editorials and articles accounted for only 9-16 per cent of the total items and rest of them were the news that has been communicated to the press. This rightly suggests that newspapers are doing the function of just relaying the news on issues of crucial nature rather than arousing a strong public concern.

TABLE III

Newspaper Coverage on the Silent Valley (January 1979—June 1980).

Newspaper	*Total No. of Items*	*Percentage of total items*		
		News items	*Editorials*	*Articles*
The Hindu	44	84.1	9.1	6.8
The Hindustan Times	39	87.2	7.7	5.1
The Times of India	22	91.0	4.5	4.5

Role of Newspapers—Results of the Opinion Survey

The opinions forwarded by the students are summarised and presented in Table IV. As much as 26 per cent of the respondents maintained

TABLE IV

Newspapers' Role on Mass Awareness of Environmental Problems

Opinion	*Percentage of total respondents*
Positive role	26
Limited role	74
Reasons for the limited role:	
Illiteracy rate is high	18
Readers are indifferent	11
Coverage is inadequate	28
Articles are superficial	10
Indian language papers don't publish	48

that the newspapers play a significant role in creating mass interest on the current environmental problems through their frequent publication. However, 74 per cent of the respondents pronounced that the Indian Press could play only a limited educative role for serveral reasons. A low literacy rate of about 30 per cent of the population and newspaper readership of a meagre 10 per cent and the primary reasons for this. Besides the ineffectiveness of the press might also be due to: (i) the varying receptivity of the readers,[3] (ii) the inadequate importance given to the problems by the newspapers. The readers by virtue of their composition are heterogenous in nature and as such the information presented cannot be expected to reach all individual reader with equal interest. Added to this, the indifferent attitude of the reader to the environmental problems leaves him with no relevant idea assimilated. As for the press, the students felt that the coverage on environmental problems is inadequate and even the articles are superficial. This lack of indepth handling of the problem hints that most of the newspapers might have no staff with scientific and technical expertise to produce original investigatory items. The other reason why Indian newspapers are ignoring the most vital of human endeavour is because they seem to be obsessed with politics and politicians[1]. Another observation made by the respondents relate to the absence of reporting on environmental issues in Indian language newspapers which serve three out of four newspaper readers. As a result, a significant fraction of the readers remains unaware of the problems.

Evaluation of Mass Media-Public Interaction Models

Two mass media-public interaction models evaluated Parlour and Schatzow[5] for their suitability to Canadian situation are given in Figures 3 and 4. Both these models were appraised in their merit of applicability to Indian examples. The Public-mass media interaction model (Figure 3) according to which the media react then create public concern can be explained well by few examples. Chipko Andolan, the popular 'Tree Hugging Movement' started as a protest against commercial forest policy and latter metamorphosed into a fullfledged crusade for the protection of forests. This symbolic movement was born in Uttarkhand with the local villagers as its enthusiastic crusaders. This event demonstrates that the affected public registered an initial concern about the problem which was only later reported by the newspapers. Several other local problems also fit in this model. The adivasis felt concerned over pollution of hill streams along their village by the discharge of water used to wash and screen lump iron ore at a mining project. (Adivasis Agitated Over Water Pollution—The Times of India, 21-1-1979).

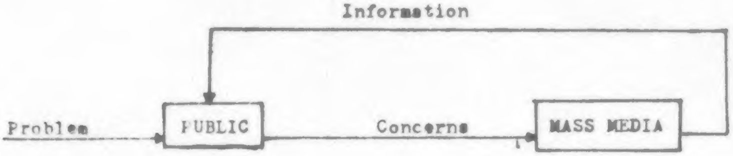


Figure 3: The Public - Mass Media Interaction Model

(Source: Parlour and Schatzow, 1978)

The elite-mass media public interaction model can be explained by controversial projects like the Silent Valley hydro-electric power-project and the Mathura Refinery. Here the ecological threat of the hydro-electric project or environmental pollution from the refinery were brought to notice by individuals, including scientists, engineers, conservationists etc., who played a substantial role in promoting the initial concern of the mass medium. These individuals, who are well informed and socially aware also served a relay function in disseminating the information about the problems to special interest groups. (Save Silent Valley Committee, Kerala Sastra Sahitya Parishad, Society for Environmental Education, Kerala, Friends of Trees, Da Vinci Environmentalists, to name only a few). These groups besides promoting the flow of communication to the press, helped to increase the public concern through poster campaigns, street corner discussions, exhibitions, etc. (indicated by dotted lines in Fig. 4). Thus, the combined influence of the individuals' concern with the mobilisation by special interest groups result in increased communication to the general mass through wider newspaper (mass medium) coverage.

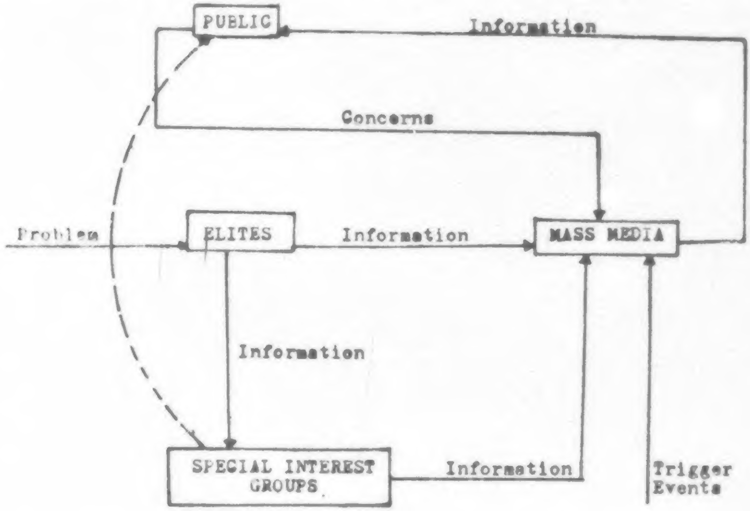

PUBLIC
Information
Concerns
Problem
ELITES
Information
MASS MEDIA
Information
SPECIAL INTEREST GROUPS
Information
Trigger Events

Figure 4: The Elite-Mass Media - Public Interaction Model

(Source: Parlour and Schatzow, 1978)

Inferences

Emerging from the present study are the following points which may serve as source material for evolving strategies and in defining the role of Indian Press as far as the environmental issues are concerned.

1. The Press requires writers and reporters with scientific and technical competence needed to publish indepth, original and explorative stories of the issues for the press to perform a meaningful educative function and to foster environmental awareness. The publication of environmental information should not be

done in a 'fill-the-gap' fashion.

2. Scientists should evince interest to become involved in the socialisation of scientific knowledge on environment through the press. The press should, on the other hand, encourage write ups from scientists, which, alone can provide authentic environmental information.

3. To make the interaction complete, the enlightened section of the mass should take up the task of spreading the message on matters of environment among the uneducated public. These will bring greater awareness and untimately larger mass participation in dealing with issues of environment.

References

1. India—A Reference Manual, Publications Division, Ministry of Information and Broadcasting, Government of India (1980).
2. R.C. Mishra, "Towards breathing fresh air: preparing public opinion to meet pollution's challenges", Chem. Age of India, *28*, 448-49 (1977).
3. Nan Lin, "A comparison between the scientific communication model and the mass communication model: implications for the transfer and utilization of scientific knowledge", IEEE Transactions on Professional Communications *PC-15*, No. 2, 34-38 (June, 1972).
4. "Seminar uncovers many failure of Press today", The Hindustan Times, New Delhi (9-2-1980).
5. J.W. Parlour and S. Schatzow, "The mass media and public concern for environmental problems in Canada, 1960-1972", Intern. J. Environ. Studies, *13*, 9-17 (1978).

Population Education and its Relationship with Environmental Education

DR. (MRS.) SUSHAMA MERH*

Introduction

It is a fact of knowledge that population, the aggregate of organisms, either plants or animals including the human species, and their environments are inseparable entities. One cannot talk about population outside the complex composition of nature. Human beings, even in their most primitive form, were not isolated individuals. It was the human species, the population, that evolved biologically and culturally through the processes of interactions with the evolving and transforming environment, thus adding socio-cultural and technological dimensions to the natural system. Environmental elements such as water are associated with all great human civilizations, including that of the Indus Valley, during which movements of people, the nature of human settlements, their distribution in time and space, all tell us the story of the close linkages between the population and the environment. Hence population-environment unity is basic to all our understanding, interpreting and conceptualisation of the issues under discussion.

Ancient Indian tradition teaches us that all forms of life—human, animal and plant—are so closely linked that any disturbance (as distinct from fluctuations) in one gives rise to imbalance in the others. The natural system itself reflects a state of balanced co-existence, self-regulation and economy. Yet, somewhere along the line these values have been lost from our perceptions. Alienation of man from the environment in the modern times is obvious from his fragmented vision and compartmentalised treatment of various complex issues. Our developmental strategies and educational programmes are also afflicted with this fragmented vision, creating imbalance and disequilibrium. This fragmented vision and discord in human development is the result of unidimensional models of analysis and operation we have applied to resolve our problems. The shortsightedness of this approach has been under critical examination in recent years. This critical re-assesment is evident from the various international and national deliberations that have been taking place under the auspices of the United Nations and its various agencies during the past decade or so (the 1970s) in the areas of concern like Environment (1972), Population (1974), Issues related to Women (1975), Child related problems (1979), New and Renewable Resources (1981), Food and Water (the Decade of Potable water), to mention only a few of the major efforts as part of the International Development Decade.

---

*Project Coordinator, Population Education Project.

Population and Environment: The Changing Perceptions and Perspectives from 1960s to 1980s

It was in the sixties that "population" and "environment" caught the eyes of the public through the media projection of the image of "doomsday", "population bomb" and "population explosion". The epicentre of the "population crisis" was Asia, the home of half of the world population, with India being the second largest in population, second only to another Asian country—China. "Numbers" became the focus of attention for the developing world. "Environment" was interpreted in terms of "pollution" as a result of the experience of intensive technological development and industrialisation of the West and was presented as a serious concern for the developing as well as for the advanced countries. It was suggested that the developed countries should remove the bad effects of industrialisation while the developing countries should not at all tread that path where serious danger to their environment is bound to meet them. Educational responses to the public concerns were reflected in the initiation of Population Education and Environmental Education Programmes in the developing and developed countries alike, treating both population and environment as isolated phenomenon in their content and dealing with them both in the narrow perspective of "crisis" and "pollution" "management."

During the 1970s the two areas of concern attained a global significance as the world realised that happenings in one part of the world often can have serious repercussions for another part and that environmental problems do not recognise state boundaries and do not require visa, and since then ever increasingly have been the focus of study and debate as well as of active investigation in various parts of the world, more specifically in the developing countries, under the auspices of UNESCO and its various agencies like the UNFPA and the UNEP in their respective educational programmes. As a result of the efforts of the specialists in the field of education and policy makers from the member countries working on these programmes, valuable professional studies and analytical documents have come out during the past decade. The deliberations and recommendations of the United Nations, and of the international conferences on population, environment and on the status of women during the 1970s have contributed to a comprehensive understanding of these areas in a global and total developmental perspective. These understandings are still to be incorporated in the content of the respective educational programmes prevalent in the different countries concerned.

Population Education: The Emerging Dimensions

The expression 'Population Education' was coined in the late sixtiees to save an educational programme from mis-interpretations due to its association with family planning and population control. India was pioneer in initiating Population Education through the formal educational system through the efforts of Population Education Unit of the NCERT under the guidance of Professor T.T. Mehta, but could not make much headway due to the amorphus nature of the concept at that time all over the world and its controversial, value-laden nature and lack of professional expertise as well as educational point of view.

During the past decade perceptions about Population Education have generated much debate and discussion in evolving a theory of Population Education. These issues centre round such views as the following:

(a) Population is only one of the causes of poverty and reduction in population growth rate is no guaranty of social and economic progress.

(b) Population is not only a problem for the poor, industrialising and developing countries. The consumption based life-style of the people in the industrialised countries has equally contributed to the problem of resources depletion, environmental deterioration and poverty in many parts of the world.

(c) While the improvement of the quality of life is universally accepted as a desirable norm, this concept itself has different connotations which are linked with particular value systems. The relationship between population parameter change and quality of life of a country at the family and at the societal level therefore, should be seen in term [illegible] the individual and societal values and backgrounds.

It is being increasingly recognised that the population issues have to be analysed, interpreted and resolved in relation to developmental and environmental factors within a holistic and interdependent systems approach. There is a need to establish a dynamic equilibrium in the system and to evolve a sustainable developmental strategy. This aim recognises not only population and environment (as resource) in isolation. For such an understanding interaction between the population and environment becomes of utmost significance. The socio-cultural, the value, framework acquires an added significance.

To cope with and improve life in our complex environment, people must understand the basic forces at work in a constantly changing ecological and social systems. In order to grasp new demographic trends that affect these systems one must first understand how they interrelate with the forces of technology, political and economic institutions and cultural values. Population literacy entails a rational and scientific understanding of the reciprocal impact of population changes on these systems and of alternative courses of action to be taken both at the personal and societal levels.

Thus the concept of population education has been broadening to focus more and more on the bidirectional interrelationships between population, developmental and environmental processes. The range of issues involved are both quantitative and qualitative and cover both micro and macro levels of analysis.

It has been pointed out that population-environment relationship is an inter-penetrating one. It is natural that population related problems should find a reflection in the field of environmental education. Before we go into this interrelationship it would be only proper to have a look at the developmental stages and working framework of environmental education itself.

Environmental Education—A New and Growing Dimension

The remarkable progress of science and technology and specially its rapid growth in the newly independent countries of the third world are a phenomenon of world significance. This progress has added a new aspect to the problem of the environment: refinement of instrumentation to monitor what was not "visible" earlier, media, specially the visual one, to make people realise the facts as they are and reducing the world to a single whole. More and more the world has come to realise that it is not only better but also more economical to prevent deterioration rather than to cure it. Environmental education as a movement, has borne out of it.

Like population education, environmental education has the entire population as its "target audience". Environment is the concern of every body. Hence, though developing as an area of interdisciplinary research and higher education oriented towards studying the monitoring of environment, environmental education has developed two very pronounced tendencies or aspects: firstly, to influence the formal educational system where individual subject elements are emphasised for their environmental relevance or hitherto absent relevant elements are incorporated into the fromal educational system. NCERT in India and UNEP at the international level, are two of the many such attempts at involving fromal education for the inculcation of environmental consciousness by "catching them young". The chain of "public schools" led by Doon School at Dehradun is also worth mentioning in this connection. In this set up from text books to eco-development camps all curricular extracurricular and co-curricular forms are used to educate the children in problems related to environmental improvement and inculcating in them a love and respect for the environmental surroundings in which they live and study. Secondly, through mass media, both audio and visual, the people at large are made conscious of the environment and problems related to it. It is true that a certain element of panic also appears to be there in some cases and exaggeration is not altogether absent from the writings often appearing in popular press. But, with serious potentiality looming large in case we neglect the environment, it is better to sin on the right side before it is too late than to be compliacent about it. Press, radio and television have all played a very positive role in bringing about enhancement of average consciousness. The debate that last for long concerning the Silent Valley in Kerala and the one that went on round Pollution effects on Taj Mahal are two of the recent examples to show how effective this aspect of "education" has been. Environmental education has already shown some positive results.

Recent trends, based on the experience of the past, show interesting development. What began as a movement against pollution, specially against nuclear and chemical pollution, has grown out of it. Today environmental education is not confined only to pollution, but is fast developing into a positive attitudinal inculcation in the mass of the people.

From the point of view of education, environmental education can be divided into three sections. First one, as shown above, concerned with the people as a whole, second one dealing with the school going children and the third one dealing with research in problems related to environment. It is even in the last section, that of higher education, that the over emphasis on pollution is slowly giving way to a deeper concern for the phenomenon taking place in nature.

Environmental education in the developing countries is in its infancy. Poor resources hamper its rapid development. Dichotomy between the traditional past and modern outlook often creates serious problems. Colonial past of the recent times helps in further complicating the situation by pointing to the problems, environmental, social and economic that industrialisation of the Western type may lead to. Hence in the developing countries, like India, environmental education cannot remain indifferent to the direction of national development and the social goals that the society has put before itself. It is heartening to note that, as in India, environmental education has from the very beginning taken a healthy position that the nation very much needs industrialisation but has to be cautious about the mistakes that very often crop up in this process due to motives of private profit. A judicious mix of formal as well as non-formal educational systems is responsible for the early successes that environmental education has so far achieved in India. This growth of mass consciousness regarding the deep involvement of all in problems of environment is the guaranty of further successes in the direction of achieving technological and mental oneness with nature.

Population Education and Environmental Education: Convergence and Possible Symbiosis

We have seen that population education that emerged as an aspect of education discussing the various implications of demographic changes, has transformed itself to much wider field that involves a large number of inter-faces with different subjects covering both formal as well as non-formal modes of education. Based of analysis of demographic data, population education tries to inculcate a value framework that is based on rational decisions concerning problems involving an individual at all levels of his/her existence. Similarly environmental education, as it emerged out of its shell of "population" has developed all these characterstics and involves all levels of ones existence. There are many ways in which the two can help each other to mutual benefit.

Population education can be taken as a co-acting component in the general spread of consciousness of urgent issues affecting the whole mass of the people.

Let us look at the overlapping areas in a bit more in detail.

Health is one of the priority areas of population education. Water and air components of it is common to both environmental and populational concerns. Water-borne diseases are one of the major problems of almost all developing countries. This links population education with the concern with water pollution. Besides health, water and air problems enter the concern of both the areas through their impact on the quality of life component.

Consideration of the quality of life brings us to another area of primary concern to both population and environmental education. Improvement in the quality of life invariably leads to more consumption of natural resources—both renewable and non-renewable—are involved in the development of a region. It cannot be that either population education can ignore the environmental impact of their undestanding or the environmental component can side-track the impact of the improving quality of life. Both these aspects of education have to work together in evolving a value framework that shifts the present emphasis from consumerism to planned development that looks upon resource development as a balanced system of consumption and re-development. Once again the two educational systems are joined at a higher level of value-judgement inculcation that is the heart of all education.

If we do not emphasise demographic aspects it is not due to any effort to ignore them. Their importance is obvious. Population education has primary concern with change in the demographic aspects of a population that directly goes to affect the environment. There is no demographic aspect that does not influence both population and environment. This very strong bond can help both these areas to coordinate their efforts and evolve parameters and criteria that are useful for a complex study of environment in relation to population. After all, our concern with environment emerges out of the historical reality that after a certain stage in the increase of population, the environment begins to get critically affected and act as a limiting factor.

Educational aspect of the quality of life is again a concern common to both these areas. Without educational upliftment neither population can achieve an improvement in the quality of life not environmental improvement can take place as technical know-how and skills play an ever increasing and significant role in the rational management of the environment.

It is heartening to know that the annual bulletin of the UNESCO Regional Office at Bangkok, 1981 has devoted its entire issue to Environmental Education, treating it as an inseparable companion of Population Education. This understanding is to be further deepened and widened to bring the two aspects together at all levels.

Recommended Sources

Population Education

1. Training Manual in Population Education. UNESCO Regional Office for Education in Asia, Bangkok, 1978.
2. Population Education: A Contemporary Concern. ISCOMPE, UNESCO, Paris, 1978.
3. Population Education in Asia—A Source Book. UNESCO Regional Office for Education, Bangkok, 1975.
4. Innovative Structures and Approaches to Population Education, Regional Workshop, Draft of the final report. UNESCO Regional Office, Bangkok and NCERT, New Delhi. 1979.
5. Population Education—A Source Book on Content and Methodology. UNESCO Regional Office, Bangkok, 1980.
6. Coordinated Action Programme for the Advancement of Population Education (CAPAPE)—Research Project on the Study of Interrelationship between Population, Environment and Development. UNESCO, Paris, 1979.
7. CAPAPE Project: Study of the Contribution of Population Education to Educational Renewal and Innovation—Case Study of Country programmes., UNESCO, Paris, 1980.
8. Population Education; Proceedings of the National Conference—Population Reference Bureau Inc. USA, 1977.
9. National and State Plan Projects in Population Education. NCERT, Population Education Unit, 1979-80.
10. Jayasuriya, J.E., Curriculum Innovation Through Population Education. Sarvoday Press, Moratowa, 1978.

Environmental Education

1. Smt. Indira Gandhi, Key-note Address to International Conference on Human Environment, Stockholm, 1972, UNESCO, Paris.
2. Proceedings of the Intergovernmental Conference on Environmental Education, Tibilisi, Georgia (USSR), UNESCO, 1977.
3. INDIA—Country Report; Intergovernmental Conference on Environmental Education, Tbilisi (USSR), UNESCO, 1977.

4. Environmental Education; UNESCO-UNEP Newsletter, CONNECT, Vol. V, No. 4, Dec. 1980 (Paris).
5. Environmental Education, Annual Bulletin; UNESCO Regional Office Bangkok, 1981.
6. Saveland, Robert N., Handbook of Environmental Education, 1976, International Case Studies.

General Sources

International

1. World Conservation Strategy: A Document, prepared by IUCN, UNEP, FAO and UNESCO, 1980.
2. Population Debate: Dimensions and Directions (in 2 vols.). Papers presented at the World Population Conference, Bucharest, Romania United Nations, 1974.
3. The State of the World Environment, UNEP, 1981.
4. Teachers' Study Guide on the Biology of Human Populations (Asia) UNESCO, Paris, 1975.
5. Special Issues on Human Population, Scientific American, Sept. 1974.

National (INDIA)

1. Sixth Five-year Plan (1980-1985), Government of India, New Delhi.
2. Report of the Committee for Recommending Legislative Measures and Administrative Machinery for Ensuring Environmental Protection (Tiwari Committee Report); DST, Government of India, 1980.
3. INDIA, Third Session of the UN Commission on Human Settlements, Mexico City, May 6-15, 1980, DST, Govt. of India.
4. Aqueil Ahmed, Project India 2000 AD, DST & NCST Ponel on Futurology, CSPMR, Administrative Staff College of India, Hyderabad, 1981.
5. Mamoria, C.B., Social Problems and Social Disorganisation in India, Kitab Mahal, Allahabad (UP), 1981.
6. Seth, S.C., Environment: Some Futuristic Considerations, Journal of the Madurai Kamraj University, Vol. IX, No. 1, June 1980, pp. 95-100.

UNFPA Population Profiles (No. of the series)

1. Law and Population (No. 2)
2. People in Population (No. 4)
3. Labour and Population (No. 5)
4. ASIA—Home of Half the World (No. 6)
5. Women, Population and Development (No. 7)
6. Population Education (No. 11)
7. Population and Mutual Self-Reliance (No. 12).

Poverty and Environment

K.K. KHATU and A.R. D'SOUZA

Introduction

Some nomenclatures are inseparable from our life and many of them lack precision. The terms such as 'poverty' and 'environment' are more often used to express situations that human race consciously experiences. The perception of any such term depends on what and how one visualizes the same in reference to one's experience of counter situations. It is a simple rule that one does not understand the reaction limits unless one knows in full, the action capabilities of process in reference. The terms, therefore, are expressed relatively and in reveric.

Much has been talked all over the country about the need for awakening the environmental consciousness and removal of poverty. Our planning has also been focused upon these two concepts. The planning attempts have been made at both micro and macro levels to minimise the environmental hazards which follow immediately after the reckless development that pushes a section of the society in poverty. Sometimes the realization of such long range effects of materially and socially deteriorated conditions demoralise the community at large.

Poverty

Poverty is a concept which has been discussed at length by many social scientists in our country. But often it was related with the purchasing power and the material benefits that one is able to accrue from a'fait accompli' of one's activity involvement. The unemployment or marginal employment with comparatively low or little income has always been considered as the main parameter of poverty evaluation in any situation, unless a few, who inherit the wealth. This approach towards the poverty concept is, however, very much individualistic and humani-

---

*Dr. K.K. Khatu and Mr. A.R. D'Souza are in the Research and Consultancy Wing of Operations Research Group, Baroda.

tarian, but in the context of 'Earth as a Spaceship' it is incredulous and, thus, improper. The ignorance about or inadequacy of resources and non-availability of appropriate technology, similarly indecisive attitude towards apportionment as well priority fixation, may also lead to environmental poverty situations. The inability to use and allow the future generations, the resources of past and present, the over exploitation and least care for conservation could also be called poverty. The human attitudinal parameters disregarding environmental hygiene which conflicts with ecological balance, can also be considered poverty.

The poverty of thought is the next and it regardlessly continues hampering the environment than any one among the socio-economic or politico-cultural situations of poverty does. Therefore, it is in the interest of all and especially of those who wish to progress not alone for themselves, but for the posterity; the poverty of thought needs to be initially eliminated. This will certainly pave a road for perspective, purposeful and decisive development of both, the habitats and the inhabitants therein.

Environment

The neighbourhood is a popular expression for an environment while activities generated by its incumbents and neighbours, whether they be biotic or aboitic, regulate the processes that shape an environment. The parameters of environment are thus many, as well any that could be visualised within the reference time. The generation of quality of environment and the intensity with which the within-processes operate, either in favourable or in the adverse manner, decide stability of ecological balance.

The land and water resources are so closely associated in any developmental activity that it is unwise to separate their roles, knowing fully their coexistence and coactions which lead to material benefits for agricultural, horticultural, piscicultural and anthropo-cultural development.

The dichotomies such as urban-rural, formal-informal, voluntary-compulsory, public and private etc., can be best understood if environmental assessment is undertaken, and the conscious efforts are made to delineate the limits of each such category.

Poverty of Resources

On one hand, the regions having abundant resources with least exploitation are normally considered poor, while on the other, regions with scarce resources, being over-exploitated, are also earmarked, soon to be poor. Therefore, immediate gains through utilization of resources may be deceptive as the posterity will suffer.

Becht and Belzung (1975) have said; "Lack of regard for environmental factors helped destroy the great civilisations of the Middle East, in the Tigris and Euphrates valleys, and in Jordon. Their demise is history. To the deforestation and overgazing of the past, man today has added air pollutants at levels which inhibit photosynthesis, he has introduced oxygen using chemical agents into the lakes, streams and aquifers; he has released insecticides, harbicides, and radiation; and he has covered millions of acres of garbage, spoil and mining gangue."[1] This conduct of misuse of resources is well noted by planners and scientists all over the world. The concerndness with which planners are looking into these problems, is though not impartial, it is yet a welcome step.

Normally the resource related problems are being solved on crisis by crisis basis and rarely in an integrated manner. Therefore, the real solutions to the problems of global nature are rarely sought, thus, leaving behind the undesirable growth trends. The resources utilization is normally based on the political decisions compatible to economic planning, keeping in view the aspirations of the citizens in vogue. Rarely the environmental constraints and posterity is viewed consciously, and as a result restrictive approach followed, hampers the future benefits. Science and technology have many answers for such environmental planning problems probably the very desire to adopt the environmental policy wherein compromises and sacrifices are necessary, becomes hard decision to take for any agency in power. A thoughtful planning which helps keeping generations thriving on resources utilisation as given or modified, is urgently needed as substitution to materialistic approach. The advance countries are realising the importance of such a shift needed in their approach from 'products' economy to a 'processing and service' economy. This, however, does not mean to reduce the importance of resources, but it suggests the deviation of activities from the one that is exploitative. The richness of resources therefore, needs to be experienced in its conservation and not alone in its preservation.

Poverty in Habitat

It is the physical environment in which one lives all, or at least more than half, the average day. Therefore, the identification of factors in the physical and social components of the residential environment of urban residents that relates to health and disease or to safety and injury; becomes necessary.

---

[1] J.E. Becht and E.D. Belzung, *World Resources Management*, Prentice Hall, New Jersey, 1975, p.x.

The long range goal of such public health concern is to effect both structural and operational changes in human settlements so as to bring down the incidence of disease and other health hazards. For example, the provision of safe water supply system in rural areas and underground drainage and sewerage system in many urban areas could be main change agent to bring respective settlements to healthy situations. The understanding of the roles played by man in shaping physical and social components of his habitat, is thus warranted.

Gross deficiencies and inadequacies related to minimum standards of basic shelter, basic sanitation and basic safety is nothing but proverty of the habitat. Number of such poor settlements exist in our country. The well planned cities like Chandigarh, Gandhinagar, New Delhi, Mysore, Bhubaneshwar have been exhibiting poverty, although in pockets in their urban spreads. The growth of slums in urban areas has now become an incurable problem leaving behind its negative effects; thus challenging the city planners. Hinkle (1977)[2] suggested a five point gradient for measuring the negative effects of observed clusters of environmental factors upon people. Those are, "in order of their seriousness of effect or distance from an ideal environment, and the extent to which an environment presents conditions contributing to (a) shortened life, (b) disability or impairment, (c) failure to reach full biological potential for growth and development, (d) constraints upon ability to engage in necessary or desirable activities, and (e) failure to provide pleasure or satisfaction.

Community and Environment

The population growth in the world has been quite alarming, especially, when one views community living practices; whether it be in a developed country or undeveloped. Man's dependence on nature and nature's safety at the mercy of man, these two reciprocal relationships are wellknown. Traditional use of fuel, dumping of municipal sewerage, and industrial waste into nearby rivers, increasing applications of fertilizer dosages, wide acceptance of D.D.T. and alike chemicals for controlling menace of malaria, rodents, etc., have produced a new realm of threats in the contamination of environment.

[2] Lawrence Hinkle and W.C. Loring. (eds.), *The effect of the manmade environment on Health and Behaviour;* Chapter VII, 1977, pp. 241-262.

We have been occasionally experiencing in our country the glimpses of such hazards. Within the community, we can now identify two distinct groups, the first being known as polluter and the other as non-polluter. The role played by each community as polluter and the role played by other community as receiver is though known, the community, which is vocal, fast attracts the attention of the decision makers. Similarly the nuisance value also decides the priority for attending the problem. For example, the urban shelter problem is being attended in a manner, as if, it comes second to the traffic problem or other city problems. The slums thus keep growing unabated till it attains the nuisance value: than the problem is looked into. The poor continue to live in poor environment not because they are poor or they keep away from change, but implications of their poverty are not yet properly understood by the rich. The rich also pollute the environment equally as the technology at their disposal is unable to take care of their innovative ways of community living. The rich community may not always be enjoying rich environment, nor poor community is everywhere found distressed by poor environment. The lack of facilities and services may not necessarily lead to bad environment, similarly, an effluence may not confidently conclude as free from all pollutants. All advanced countries are probably shelling out more money on getting rectified their environmental mistakes, than what the underdeveloped countries are feeling deprived of. The cost of technology is high and the price to be paid for its transfer is incompatable to any community.

The essential features that could be looked into by the emerging urban community in adopting the technological transfer and maintaining the environmental richness, are; (1) a pre-set maximum size and residential density; (2) putting work, school, home. shopping and recreational areas close together; (3) eliminating the conflict between pedestrian and vehicular traffic; (4) maintaining social diversity among the residential population; (5) encouraging strong community participation by residents; (6) providing smooth transition between phases of planning, construction and municipal operation of community, and (7) providing a greenbelt surrounding the community. In an old and established community many of such features are not easily introducable. But by determined efforts it will not be utterly impossible. Therefore; it is also expected that new patterns of public actions for environmental protection will emerge simultaneously. At present, effective mechanism does not exist for adopting constructive approach to community organization and programmes of local agencies for urban environmental improvement. This primarily a managerial problem rather than an economic problem; a clear-cut case of poverty of thought.

Environmental Education for Slums

It is not easy to educate people and there are not many trained to do this also. The traditions, superstitions and faiths are so deep rooted and also the attitudes of people so rigid that hardly any dent is possible in a short period. The context of their behaviour and the aspirations they hold are so complex phenomena that it requires thorough study of community and community livings, whether it be rural or urban, rich or poor, educated or uneducated, skilled, or unskilled, etc.

The slum community is one of the types that has been under study since its appearance on the urban scene. But hardly anywhere in the world the policy makers have succeeded to win over the situation. Rather, problem has been becoming more and more complicated and very much sensational than over before. This is because on the one side the magnitude of the problem is increasing and on the other the solutions are fast loosing from the concerned's sight.

The real remedy to the problem lies not alone in the environmental improvement of physical characteristics of slums but also in educating the slum people about environmental hygiene. The organisation of slum areas with respect to health, hygiene and recreation, maintenance of environmental cleanliness, etc. would be a boon to the residents.

The programmes to educate people on environmental cleanliness, to demonstrate ideal habitat on a continual basis, to increase their faith in observance of rules and regulations, to ensure the interest of all, including rich industrialists and city authorities in maintenance of the environmental standards etc. will help boosting the morale of slum people.

A comet like environmental programme with sparkling effects would not last long in such areas; but a policy like slow and steady will help a long way and the people will get used to new way of life. It is not mearly destiny that has put them in such areas but they are there due to the lack of foresightedness on the part of those who claim to be educated on environmental planning and implementation. Our cities do not lack in resources but we knowingly keep all the city-eyesore problems away from our minds—determination.

Regional Context

Universe of these problems is quite wide as it appears on one end at micro level, and on other end on macro level. The city environmental problems normally merging in city fringe problems further become area problems, sometimes even crossing the administrative boarders of the State and in few cases, depending upon the magnitude of damage done and knowledge attained, crosses the country limits also. The pollutants released in air, rivers and bays cross the country and sustain enjury to far off places. The need for environmental education at all levels of polluters and the users of such polluted resources is thus warranted.

Normally regional disparities are attributed to the resources availability indigenously. But it is also equally related to the misutilisation, underutilisation or overutilisation of resources. Therefore, the policy makers and decision makers are required to be educated and cautioned on various environmental issues that generate from their enthusiastic actions. Irrigation is one such action that is being attended, in our country, by many environmentalists and has been highlighted occasionally to take cognisance of its impacts.[3]

World Scene

A cursory look at the world map will clearly indicate the developed and underdeveloped countries from the point of view of their economic development. The scale for measurement of development is unfortunately biased with materialism and not environmentalism, as it should be. Therefore, what is developed, all may not be necessarily desirable. For example, the urbanisation is growing fast and the centres of habitations are also increasing in absolute number. The faith in congregation is getting deep rooted; and the people and industry are increasingly getting concentrated in few pockets putting pressures on phyical as well socio-economic environment. Fortunately many of the underdeveloped countries still fall in zones that are environmentally safe, while developing countries stand on the threshold. The poverty of environment thus could be ascribed to the status, and type of development, besides the technology choice. Secondly the macro analysis of environmental problems become important than merely looking into the micro level aspects related to short term benefits.

The world corporation or supernational company could be one amongst very few solution now known to the world, to overcome the mad race amongst the big powers to own and monitor the rare resources of our planet. Conditions precipitating the multinational corporation of today and the world supernational companies of tomorrow are both clear and subtle.[4] Many nations are looking beyond their boarders for raw material. Therefore, inhouse resources are becoming so important that the tendency of keeping them in reserves and using those which are easily accessible, is fast incressing amongst all nations, whether be developed or developing. This will create a new problem of imposed restrictions on use of resources, thus creating temporary scarcity situations. The struggle for survival in case of energy resources, has already appeared on the world horizon. The gulf countries will hold the key till other nations do not find appropriate technology transfer with least damage to the environment. 'For resources in reserves and resources in use the global stock is needed to be taken to put all resources meaningfully in use, otherwise imbalances will increase and tensions will continue till mankind exists on this planet.

---

[3] Operations Research Group, Impact of Medium Irrigation Projects on Environment: Cases of Gujarat and Rajasthan, Project sponsored by USAID, 1970-80. (Mimeographed), Baroda.

---

[4] J.E. Becht and E D. Belzung, *op. cit.*, pp. 312-319.

The views expressed herein are entirely of the authors and not of the organization they belong.

Environmental Education—Metaphysics and Integral Education Strategy

J.S. RATHORE*

Introduction

In his famous book *Small is Beautiful,* E.F. Schumacher[1] has pointed out:

'The modern world has been shaped by its metaphysics, which has shaped its education, which in turn has brought forth its science and technology.' And about the type of the world shaped by contemporary metaphysics Schumacher remarked:

'It tumbles from crisis, to crisis, on all sides there are prophesies of disaster and indeed visible signs of breakdown.'

What is the metaphysics of our contemporary world? Is there a *real* crisis a *real* possibility of breakdown? Or these are mere garbles of some discontented and disgusted men who are just imagining things. These are pertinent questions which need to be asked. Answers to these questions are of paramount importance because they alone will give us clarity about such discomforting questions—Why this frantic campaigning for environmental education? Why environmental education is that much important? Should we encourage this sort of lobbying in scientific and academic circles?

Metaphysics of Technoculture

The metaphysics of technoculture, in which we all are living, is not existing in the form of a written document though most of the books propagate it in one way or the other. Formal systems of modern education are genuinely unaware of it, though they are the products of this

---

*Head, School of Environmental Biology, Dean, Faculty of Life Science and Dean, Faculty of Home Science, A.P.S. University, Rewa, Madhya Pradesh.

metaphysics and work only to strengthen it. Sciences and technologies do not mention it though they have contributed enormously for making it the universal philosophy of contemporary human life.

This metaphysics exists in our minds. It has become part and parcel of our memory system and behaviour. It has become our second nature shaping our life and aspirations.

In a remotely located Indian village or an Indonesian village or for that matter in any village, a young farmer and his young wife appear happy and buoyant. They had a nice harvest and could collect good money. Enthusiastically they make a list of all of those which they longed to purchase all these years. It is this metaphysics which like a mystic abstract force conditions their choices. What to aquire? What their eldest son should do? What they will do, if they had lot of money?

This metaphysics is short and simple but conceals within itself all the violence of the world and all the greed of the world. Using only three key words: 'Wealth', 'Power', 'Materials' it can be stated in one sentence: NO AMOUNT OF WEALTH, OF POWER AND OF MATERIALS IS ENOUGH FOR MAN—THE LORD OF THE NATURE.

For these extremely pleasent things, neither the sky is the limit nor that vast space is the limit which encloses 10^{11} galaxies, each with 10^{11} stars.

In an exceedingly bold article Scott Paradise[2] summarized the American ideology of man and nature to seven propositions:

1. Man is the source of all value.
2. The universe exists only for man's use.
3. Man's primary purpose is to produce and consume.
4. Production and consumption must increase endlessly.
5. Material resources are unlimited.
6. Man need not adapt himself to the natural environment since he can remake it to suit his own needs.
7. A major function of the state is to make it easy for individuals and corporations to exploit the environment to increase wealth and power.

Paradise has commented beautifully on these propositions. Table I summarizes some of his interesting and revealing statements made for each proposition.

After going through all these seven propositions, one can ask honestly. Is all this not all that which I believe and which everybody believes? Proposition ennumerated in Table I do not merely represent the American ideology of man and nature but they constitute the summary of globally accepted practical metaphysics of contemporary human life.

Builders of Technocultural Metaphysics

Industrial and Medical Revolution

From the window of my apartment I look at my gleaming car. I listen to the deafening noise of a mighty bulldozer. I move to different corners of my home and discover that from all sides I am surrounded by machines, gadgets and by things made by machines. I am filled with a great feeling of security and admiration. Man is the mightly master. Nothing is impossible for him. Proposition (2) Crystallizes in my mind and with that all other propositions because they are one and the same.

It all started some 260 years back when Europe had its industrial revolution followed by a medical revolution. Within 100 years of these events the world population, which was fairly constant, all along doubled.[3] This unprecedent numerical increase, availability of new resources and new sources of energy improved transportation, increased agriculture knowledge and newer techniques for food preservation—all these generated an unshakable faith in science, technology and machines. Lifestyles changed 'overnight' and touched *a comfort-line* which no body could even dream. Parameters of development became crystal clear-machines to produce materials, materials for more and more of comfort, tapping and exploitation of natural resources for use in production of materials and running the machines. Peoples, machines, materials and comfort. More people, more machines, more materials and more comfort. This became the golden path of technoculture.

Scientific Materialism

Professor Lynn White[4], tracing the historical roots of our ecologic crisis, speaks of Christian religion as the most anthropocentric the world has seen: it not only established a dualism between man and nature but

TABLE I

American Ideology of Man and Nature

Proposition No.	*Proposition*	*Scott Paradise's conclusions*	*Your own honest confession**
1	2	3	4
(1)	Man is the source of all value.	Every thing else is valuable only as it benefits man.	I agree/disagree
(2)	The universe exists only for man's use.	Thus if the world's whaling fleet find profit in exterminating the last of the great whales, the whales must go.	I agree/disagree
(3)	Man's primary purpose is to produce and consume.	This is the heart of good life.	I agree/disagree
(4)	Production and consumption must increase endlessly.	Goods equal the good, and nothing can quench our infinite thrist for them.	I agree/disagree
(5)	Material resources are unlimited.	The thrust of this proposition lies not in the absurdity that finite earth has infinite resources but rather than we do not need to heed the warnings of those concerned with their depletion.	I agree/disagree

Continued

Continued

1	2	3	4
(6)	Man need not adapt himself to the natural environment since he can remake it to suit his own needs.	Smog, noise and ugliness come with progress, and man can and must learn to live with them.	I agree/disagree
(7)	A major function of the state is to make it easy for individuals and corporations to exploit to the environment to increase wealth and power.	Ideas concerning private property stand central in this proposition. It is easier for a developer to destroy a beautiful old mansion to make way for new ranch houses than for the public to organize a drive and raise money to save the historic house. The government structure and operation is biased to encourage such development rather than effectively protect the natural and cultural haritage.	

---

*Even one 'agree' will reveal that you are a believer.

insisted that it is God's will that man should exploit nature for proper ends. This came handy for the western man. Hypnotized by new technoculture with new set of values--exploitation, agression, competition, self-centred growth—the western man did not pass through much prolonged *conflict of conscience* to aquire these norms. Eastern man, however, cultivated and encouraged a behavioural dichotomy and hypocrisy. He too became a convert and a co-traveller on the golden path of technoculture but not without a feeling of guilt.

Developments in biological sciences tilted every thing in the favour of technocultural metaphsics. Scientists from many disciplines, such as chemistry, biology, biochemistry, biophysics, geology, geochemistry and space-science have devoted considerable attention to the study of the origin of life and theorized that life is a manifestation of matter. They proclaimed life originated from a random combination of molecules interacting under the influence of blind natural laws over a long span of time. Some time in the middle of century Watson and Crick crowned the trinity of biological macromolecules—DNA, RNA and Proteins—as the trinity of life and lifeprocesses. Small nucleicacid chains were synthesized, genes were manipulated and recombinant DNA technology appeared on the horizon. Test-tube babies also joined the band-wagon of scientific materialism. The new norms were quite clear: Life is material. Life is molecular. Man is material. Man is molecular.

Is there any purpose, any meaning behind human life? Molecules act, interact and change in a random manner. In the words of Jacques Monad[5]:

> "Chance alone is at the source of every innovation, of all creation in the biosphere. Pure chance, absolutely free but blind, is at the very root of the stupendous edifice of evolution: This central concept of modern biology is no longer one among other possible or even conceivable hypotheses. It is today the sole conceivable hypothesis, the only one that squares with observed and tested facts. And nothing warrants the supposition—or the hope—that on this score our position is likely ever to be revised."

All these developments have started convincing man that he is not more than an aggregate of molecules, that he is a product of random processes and that these processes are blind. Life has no meaning except to act, interact and change blindly. Seen in this light, exploitation, aggression, competition, self-centred mutually exclusive growth is the only realistic set of values which is available and which is compatible with scientific materialism.

The technocultural metaphysics started as a *real experience* of pleasure and comfort generated by European industrial revolution. Modern science gave it intellectual credibility.

Table II enumerates some of the objects around us and the logical attitudes which the technocultural metaphysics has built or will build. Reverting to Schumacher[1], I submit that it is this metaphysics which has shaped our modern world, our systems of education and our science and technology. It is this world which tumbles from crisis to crisis with prophesies of disaster and collapse on all sides. What is this succession of crisis? What are these prophesies of disaster?

The Crisis

Somewhere in a cold country and in one of its lone mountain cliff home, some people were enjoying the cosy comfort of a tiny bonfire. The night become darker and the cold more severe. They were mad people because that night they put everything which they possessed in fire to pass one night of comfort. Next Might they did not survive.

The situation around all of us is not much different. Every day more and much more of people are dreaming much more of better living facilities forcing the politico-social systems to exploit more and much more of available resources through more and much more of machines which need more and much more of available resources to create more and much more of desired facilities of comfort to produce more and much more of people.

The molecular man, a chance product of biomolecular processes, is on a never ending pleasure hunt and refuses to come out of his technocultural urges of exploitation, aggression, competition and self-centred growth. The crisis is behavioural and, therefore, most deep rooted.

In the words of Scott Paradise[2]: "Some call it an ecological crisis, others admit only to a variety of serious environmental problems ranging from pollution to ugliness. In any case, the bombardment of articles, books and television programmes in the past few years have made us aware that some thing is wrong. Exploding population, advancing technology and economic development have joined to face us with a triple threat. But except for a few voices, the depth of the difficulty eludes expression." Further, we assume, rightly, that more science and technology, better planning is needed, or more adequate political arrangements are needed, but we assume, wrongly, that a combination of these will save us.'

TABLE II

Technocultural Metaphysics and Operational Corollaries or Attitudes

Sl. No.	*Object Type*	*Nature in terms of scientific materialism*	*Happening*	*Attitude**
1.	Pen	Molecular Renewable	Lost	Forget. It can be purchased.
2.	Chair	Molecular Renewable	A leg is broken	Don't worry. Get it repaired.
3.	Son	Molecular Renewable	Crushed beneath a truck	Don't mind tears. Tear glands are biological. Not an event to weep your heart out. An aggregate of nucleic acids, proteins and other chemicals got crushed. Another can be produced.
4.	Petrol	Molecular non-renewable	Scarce	Conserve it with care. Think what will happen to your car?
5.	Daughter	Molecular Renewable	Raped	Just had an unwanted copulation. What's all this fuss about?
6.	Tree	Molecular Renewable	Felled	So what?
7.	Wife	Molecular Renewable	Eloped	There are other women around. Don't bother about the institution of marriage. It has no biological basis.

*Those who find some of these attitudes nasty and ghastly should wash their conscience in the cool and soothing shower of scientific materialism.

There is a growing consensus that this dilemma has no technical soultion. According to Hardin[6] a technical solution may be defined as one that requires a change only in the techniques of natural sciences, demanding little or nothing in the way of change in human values. In the words of Beryl Crowe.[7]

"There has developed in the contemporary natural sciences a recognition that there is a subset of problems such as population, atomic war, and environmental corruption, for which there are no technical solutions. There is also an increasing recognition among contemporary social scientists that there is a subset of problems, such as population, atomic war, environmental corruption, and the recovery of a livable urban environment, for which there are no current political solutions."

Crowe[7], therefore, points out towards two insular scientific communities – the natural and the social—between which there is very little communication and a great deal of envy, suspicion, disdain, and competition for scare resource.

The Conflict

Fortunately the knowledge-growth in the different areas of environmental science brought to the surface constrains which are compulsive.

Ours is a finite world. Some may put forward a spirited defence for the view that the world is infinite. But in the words of Hardin[8], "in terms of the practical problems we must face in the next few generations with foreseeable technology, it is clear that we will greatly increase human misery if we do not, during the immediate future, assume that the world *available to the terrestrial* human population is finite," and that space is no escape. The supreme constrain is that a finite world can support only a finite population. There cannot be any greatest good for the greatest number because it is not possible to maximize for two variables at the same time. Besides, minimal maintenance calories for a man are 1600 kg calories a day. If he does some work, he needs extra calories—'work calories'. A goal leading to maximization of population would mean curtailing work calories which amounts to no gourmet meals, no vacations, no sports, no music, no literature, no act." From all these accounts this appears to be a *compulsive constrain*.

Even if we visualize our earth as a part of an infinite cosmic system, our prime concern should not be the earth but the thin envelop of biosphere or the environment, which is unique to earth, and in which man was produced as a culmination of 100 million years of evolution as a mammal, of over 45 million years as a primate, of over 15 million years as an ape. His neurological, physical and genetic attributes are adapted to *this* type of environment and there is no other *similar* alternative environment around. Rathore[8] pointed cut that the most obvious relationship between the natural ecosystems and man-made socio-economic systems is that of 'container' and 'contained'. The operating law is the law of *proportionate extendability* which in other words means that unending maximization of population would be possible only when the containing system of environment is extended proportionately in terms of space, resources and environmental quality. This goal is not in sight. Thus for all practical purposes, this constrain is a *real* compulsive constrain. There is no other alternative.

It is not only the population of man which need be controlled but also the population of machines which also seem to be growing exponentially and also needs *energy* and *space*. They also disturb and degrade the environment.

Men do not aspire *minimal* or even *optional* life-style facilities and materials. They aspire for a *projected optimum* which is generally beyond the *achieved maximum*. Even this *achieved maximum*, at any given time, is realized by a minute minority only and cannot be achieved by all without destablizing the global socio-economic systems and without putting unprecedential pressures on the containing natural resource system. The supreme constrain should then be modified so as to read: A finite world can support a finite population of machines and a finite population of those men who learn to operate at zero level of material aspirations.

The conflict is obvious. The technocultural metaphysics states: "No amount of wealth of power and of materials is enough for man—the lord of the nature." The *compulsive constrain* and the technocultural metaphysics are antithesis. The two cannot go together because they represent two different sets of values. The technocultural metaphysics should give way to the new metaphysics. Paradise[2] has corrected the seven propositions of American ideology of man and nature and these corrections make sense. The corrected versions are:

1. Man is to be valued more highly than other creatures. Man has a higher value, but others are not value-less. They should be valued too.

2. Man has become the guardian of the earth. His prerogatives to use the earth's resources are balanced by his responsibility

to cherish them, protect them and use them carefully.

3. Man is far more than a producer and consumer. Life is not merely production and consumption. It is singing, dancing, loving, discovering, learning and so many other things.

4. Improvement in the quality of life takes precedence over increasing the quantity of material production. Our social goal should be to achieve a zero rate of population increase and a state of increasing human well being with a minimum increase in material production and consumption.

5. Material resources are to be used carefully and cherished. Human fulfillment comes not through an ascetic denial of the value of material things but by passionately and sensitively embracing them. Using and living a few things long and carefully leads to a more profound fulfilling experience than the careless use and abandonment.

6. Man is to relate himself to the natural environment, remaking it according to its nature as well as for the sake of his short-term economic advantage. In a natural ecosystem man is part of a living web—a network of relationships based on mutual action and reaction. An aggressive approach to nature is bound to back-lash.

7. A major function of the state is to supervise a planning process which will prevent the impairment of the quality of the environment.

This supervisory function should not be in the form of sermonizing in the form of some sort of political cover ideology but by actual realistic management. We do not need any technocultural economic projections for future. We need practical alternative models of demographic and economic transitions within the frame of environmental metaphysics. We do not need such political systems in which poorly informed people with no foresight are allowed to reach the top of the power pyramid to lord the destinies of billions of people.

Integral Education Strategy

The Problem of Values First Strategy

The first proposition of this article is that the technocultural metaphysics should be replaced by environmental metaphysics. People should be aware to analyse and to revise their attitudes towards nature, towards themselves and towards politico-social systems in the light of compulsive environmental constrains. If our major problems have no technical solutions, and no political solutions—where do we go from here? Scott Paradise suggests that only truly revolutionary changes in our attitudes will help. How to bring about this revolution? How to establish a rapport between the two insular communities—those of natural scientists and social scientists? It should also be realized that the basic problem of value cannot be delegated by natural sciences to the social sciences or by the social sciences to the humanities. There is no escape from the responsibility for each individual to admit to and to deal with the primary problem of value which is of supreme importance. In many countries of the world, formal educational structures are educating only a minority. The problem of value system is beyond the scope of formal education structures. Even it's introduction in formal educational structures would need acceptance by the politico-social systems. This value system will have to be imposed in the form of Environmental and Development policy Acts through parliament and State assemblies. A fairly safe clean and livable environment should be declared as fundamental human right by United Nations Organization to be followed by a vigorous and enthusiastic campaign for its adoption in the form of parliamentary Environmental and Development Policies Acts by nations of the world.

Non-formal Educational Channels: Second Strategy

Earlier Rathore[9] stated:

"A pro-man and pro-environmental education is our only available option". And, "It is in the non-formal educational development, which has the wonderful potential of reaching every nook and corner of human existence without any preconditions, lies the escape from this self-imposed necessity of self-destruction." Open universities on integrated courses on environment and economic studies may prove a very useful development. These universities may produce self-instructional package courses on environment and development themes utilizing modern techniques of micro-teaching and interaction analysis. Mass media can also play a very useful and effective role in global propagation of these values. Norms supporting these values can be sorted from existing cultural streams and suitably projected. By and large religions will favour the propagation of these values because they are not much different from moral values. The new metaphyics should not be propagated as contraculture or sub-culture but as *symbiotic culture*.

Primary, Secondary and Higher Secondary Levels: Integration of Environmental Educational Components: Third Strategy

At these levels physics, chemistry and biology can be taught much more interestingly and beautifully by adopting ecosystem approach. Abiotic and Biotic compartments offer a wonderful opportunity for such integration.

The traditional cleavage of biology in the form of botany and zoology should be replaced by environmental biology.

These formal changes at these levels would produce better informed citizenry.

Higher Education: Fourth Strategy

The purposes at this level will be:

(a) to produce man power of specialists in diverse areas related to environmental sciences and related social sciences to implement environment and development policies of state.

(b) to create new knowledge and techniques to tackle and provide short-term solutions to pressing environmental problems at the regional and national levels. The whole infrastructure of the universities can be utilized for environmental monitoring and for preparing impact statements on any given situation. University departments with adequate facilities and expertise may be identified and student man-power can be used and appropriate payments be made to students. The operation would not only cut expenditure substantially but would create a semi-formal monitoring agency. This infra-structure would provide 'edrn while you learn' facilities to a substantial population of students. Charles Frankel[10] defined, "Responsibility as the product of definite social arrangements". It is not appeal to conscience or propaganda.

References

1. E.F. Schumacher, 1977. Small is Beautiful, Radha Krishna.
2. Scott Paradise, 1969. The Vandal Ideology, *The Nation*, December 22, pp. 730-732.
3. Robert leo Smith, (1972), In Ecology of Man, Ed: R.L. Smith, Harper and Row.

4. L. White, 1967. The historical roots of air ecologic crisis, *Science*, Vol. 155, p. 1205.

5. J. Monod, 1971. Chance and Necessity, trans. A. Wainhouse. N.Y.

6. G. Hardin, 1968. The tragedy of the commons, Science, Vol. 162, pp. 1243-1248.

7. B. Crowe, 1969. The tragedy of commons revisited, *Science*, pp. 1103.

8. J.S. Rathore, 1979. The Ecology of Economic Develoment. In Ecology and Development, Eds. Deshbandhu and Bhardwaj, I.B.S., New Delhi.

9. J.S. Rathore. Soft vs. Crash Landing—Alternatives for Survival, Key note address—National seminar on Environmental and Population Education, Gandhi Non-formal and Adult Education Centre, Rewa.

10. Charles Frankel, 1955. The case for Modern Man. Harper, New York, p. 203.

Analysis of Problems in Environmental Education

SWAMI YUKTANANDA*

It is a privilege to address this assembly of distinguished people from various parts of the world. Your concern about the environment of which man is an integral part and in which he lives is extremely relevant in a situation where there is still time to change the destructive course which we, ourselves, created. The aims set out for deliberation in this International Conference on Environmental Education are specially oriented toward initiating collective measure, informing and educating people in general and making decisions in particular. They spring from the need to maintain environmental harmony by evolving action programmes designed to solve the problems brought to light by environmental education.

Such endeavours will be successful only if we can draw conclusions and make resolutions for action on the basis of objective reasoning. Any effort supported by opinions only, however laudable, will be an effort in futility. The aspect of value orientation in the context of objective reasoning is particularly significant.

Over the past few decades many people have become increasingly aware of the complex natural relationships on which man depends for his survival. Ecology has become a catchword representing the movement to clean up our environment, but ecology is concerned not only with the environment but also with living organisms in relation to their surroundings and to each other.

One such organism is man. Many of the techniques which ecologists have developed for the study of plant and animal populations are applicable to the human population as a biological species. But human society is more complex than any animal society. This complexity comes from man's social and cultural aspects. Neverthelesa, man has to live in a variable relationship with simpler organisms or perish.

*Vivekananda Nidhi, Calcutta.

Environmental education is the specific discipline for training in management of our natural resources. It begins with the management of human resources. When we try to identify and analyze the problems related to ecological imbalance, we become acutely aware that our urge to transform nature is intense. Moreover, we are so overwhelmed with our ability to achieve spectacular success in outward transformation that we forget to transform ourselves. Thus we become incapable of maintaining the balance in ecology of which we are a vital part. We tend to think of ourselves as absolute somewhere outside of ecosystem, but this is a dangerous illusion when looked at from the standpoint of the day-to-day world.

When the question of value orientation arises in any context, there are two basic elements to be considered: the *valuer*, and the *value referent*. For our present discussion *man* is the valuer, and the value referent is the object, event, process or condition that forms the experiential locus of value concern. A definition of value places clear emphasis either on the attitude of the valuer or upon the value referent. In the first case we speak of man *holding* or *entertaining* values and in the second of objects, events, etc. *having* values. It is significant that the basic human values such as love, truth, etc. remain indivisible even though application takes various behavioural forms.

The word *value* is derived from the latin word *valere*, to be worthy. The Indian word for it, *mulya*, is derived from *mula*, root, that which holds and sustains. From these meanings we deduce that proper evaluation of a thing is possible only when we consider it in its wholeness, from its root. In fragmented presentation we cannot make an objective assessment and its worth cannot be properly ascertained. If the 'root' is not nourished, the tree, whatever other care is lavished upon it, will certainly die. By this reasoning, I hope that we can begin to identify in present environmental problems, a crisis of values, values that are immutable and indivisible.

The present imbalance in the environment has been created by an unbalanced relationship with the universe. Because we are not prepared to accept matter, mind and spirit as an inseparable, interdependent and interacting continuum—a consciousness transcending space-time and at the same time the very essence of it, our world-view is distorted, fragmented. As a result we value things, events or experiences on the basis of immediate and conditional gratification. But the short-term values aimed at quick gratification not only increase waste but affect the whole ecosystem, undermining eventually even those modest aims. We must come to realize not only that each gain thus achieved is temporary, but that each loss is permanent. Unfortunately species cannot be resurrected once they are extinct. Nor can places be restored to their original state. It is not possible to transform ourselves suddenly to fit in with a situation caused by the imperatives of our greed.

Value orientation means raising our awareness to the holistic world view in which valuer and valued form an interactive unit. In this perspective we get a value-added universe. The holistic view of the universe is not only observed and verified by exact sciences, replacing the primitive mechanistic world-view, but it is also supported by the mystic's experience of oneness. Our generation needs to be educated in this knowledge of the harmony between the microcosm and the macrocosm. Only by this education can we bring a dramatic change in our outlook when we shall no longer see isolation in any sphere. If we fail in this education, we will not only produce a world not fit to live in but a growing hell that eats away at the very qualities of life. Fortunately we already have the cure at hand. The question is: Do we have the conscious will to apply it?

We have passed the moment in history when value orientation in environmental education could be achieved on a regional basis. Today it must be a world movement in which each nation plays a meaningful role without losing its uniqueness. The part each of us has to play in reaching this intercultural and cosmopolitan perspective will be defined by an evolving programme of action.

Such a programme can be initiated among people when they are free from fixed loyalties. The target group should be youthful, decision-making people. Today in many countries young people grow up taking financial security for granted. In other places this security is dependent on a sound world economy. Nevertheless, the present generation shares growing up in a time of unprecedentedly rapid change. They have been forced into a global outlook by threats to global safety. They have become change-oriented and have started to feel concerned about other people. This is a hopeful sign. The time is ripe to launch a massive campaign to restore quality environment the world over.

Existence is a continuity, a growth, in which molecules of air, water and earth are transformed into life, human life. No longer can the universe be regarded as dead matter on one hand and man, the highest species, on the other. As men of the spirit saw the spiritual unity of existence, men of science now show us its organic wholeness. It is time for us to recognize the urgency of these facts:

If value orientation can be accepted as based on objective reasoning as we have tried to present it here, then the implementation will not be difficult to find and structure. Naturally our endeavours must include people from all walks of life, but not any one race, religion, political persuasion or social status can give shape to what is a movement of mankind as a whole. The principle of this movement cannot but be the unity underlying things, events and consciousness.

During the last 2 days of deliberations many of the distinguished participants stressed on multi-disciplinary or trans-disciplinary approach for environmental education. Now we find the priority in E.E. needs to be the quality input in respect of human component, particularly in the area of decision-making people. Because the success of our effort will largely depend on the objective conviction and performance of such people.

Deliberations will have any meaning when they are followed by appropriate action programmes. In the circumstances my humble suggestion is to create first at the national level and subsequently at regional level a type of institute with strong academic base and research facilities to identify the necessary value content and evolve pedagogic methods to supplement the existing training centres (administrative training, teachers training, police training camp, etc). Such value orientation institutes will arrange interaction among different disciplines, work out action programmes, motivate pressure groups, publish relevant literature and conduct continuous evaluation. The institutions will serve not only as clearing house of value based ideas and action programmes, but also to introduce necessary dynamic in pedagogy or value oriented environmental education. The dichotomy of the sacred and the profane, the secular and the spiritual will not be there to cause conflict and it will be the one continuing existence manifest as the multitude including man as its integral part and harmony on variety in the condition of sanity. Let the conference articulate the collective voice of sanity by listening to the ringing wisdom.

> Madhuvāta Rtāyate, Madhu Ksharanti Sindhavah
> Mādhvirana Santosodhih
> Madhunaktamutososih Madhumat parthivam rajah
> Madhurdourastunah pita. Madhuman me vanaspati
> Madhviman astusuryah. Madhurgabobnabantu nah.

To me who is the devotee of the Supreme truth let the wind blow sweetly and let the rivers run sweetly, let the herbs be to us sweet and beneficial let there be sweetness day and night, let the particles of the earth be sweetness bearing, let heaven, our father be sweet to us, let the fruit bearing trees be sweet to us, let the sun be sweet and beneficial to us, let the cows be sweetness bearing to us.

Some Aspects of Marine Pollution

K. KRISHNAMURTHY*

Introduction

Man is the most widespread species among the mammals. Not only has he occupied the far corners of the terrestrial world, but has also used seas and oceans that separate him from his brethren as highways of communication, transport and for his own betterment in every conceivable way. Even in his avarice and greed and quarrels, again he is using oceans as his battleground to prove his superiority over his rivals. He uses ocean to stockpile arms, including thermonuclear warheads, underwater missiles etc. So also he has been polluting the seas, contaminating it not only with domestic effluents, but also with industrial, radioactive and petroleum wastes.

The oceans have a volume of about 1.4 billion km^3. The world's population is put at 3.5 billion people. On an average, it is estimated that, each human being has 0.4 km^3 or 1 km^2 400 m. deep in the ocean for food, water and disposal of wastes (Hood, 1971).

Sources

Since the beginning of maritime trade and man's oceanic activities in multitudinous ways, such as search of new lands and the empire building activities like conquering overseas kingdoms and in search of colonising activities, the oceans have been used as highways. They are generally considered inexhaustible in all their resources. They have been used as "sinks" that could favourably receive the wastes produced by man. Now, evidences are fast surfacing from the realm of Neptune and aqueous environment that not only the estuaries and nearshore waters are being subjected to severe stresses, but also the deep oceans are equally affected, although the mixing rates between surface and deepwater

---

*Centre of Advanced Study in Marine Biology, Annamalai University, Parangipettai, 608 502.

involve some hundreds of years. Considerable time is taken to reach homogeneity between the water masses (Hood, 1971, Svendrup, *et. al.*, 1942). But the pollutant does not wait for this to happen. This underlines the magnitude of the problem, as man pollutes the biosphere at an alarming rate.

Some of the pollution-producing activities may be listed as follows:

1. Marine commerce
2. Sewage treatment
3. Recreation
4. Electric power generation
5. Construction and land use management aspects
6. Man-made changes of environment, landscape planning
7. Choosing site for fishing harbour, dredging the backwater and approach channels—altering circulation patterns of the coastal sea—due to harbour and port installations.

Action of Pollutants

The effects of pollution are well known. Man himself can be considered as the worst pollutant. The problems generated by pollution of the environment are legion. They are essentially man-made. The pathogenic pollutants are among the most important ones. One way of measuring an acute effect of pollution is by feeding the pollutant to an organism like fish and determining the dosage required to kill 50% of the organisms taken for the study. Increasing gradually the dosage to the same population and the number of organisms that perish due to this dosage and plotting the data, representing graphically the same, one obtains an 'S' shaped curve. From this curve the dosage can be ascertained to kill half the population of the sample. The lethal dosage responsible for 50% of the mortality rate is called LD 50. Comparing pollutants this way, one can estimate their relative toxicity.

The effects of pollution can either be drastic and sudden or, may take time to become apparent-like carcin genic pollutants, oil pollutants etc. The industry-associated release of pollution products like organochlorine, organo-mercuric and organo-phosphorus compounds and their interaction with the sea water are often fatalistic. The famous Minamata disease is an example of how the pollutants find their way in the food web from the water through the intermediate links. The shell-fish poisoning associated with natural blooms of toxic dinoflagellates like *Gonyaulax polyedra*, *G. tamarensis*, *Gymnodinium breve* and to some extent by *Noctiluca miliaris* are good examples of organisms causing mass mortality of marine denizens. Even human beings when they eat the shell-fish (molluscs and such of those marine organism) which have been fed by the toxic dinoflagellates suffer from serious paralysis, nerve disorders, etc. Such a possibility was recently prevented in N.E. United States of America by the timely action of the Public Health Authorities by banning contaminated and poisoned shell fish supply and their landing from the infected coastal N.E. Atlantic Waters which were teeming chiefly with *Gonyaulax tamarensis*. Even the DDT pollutant has found its way to the Antarctic-living pelicans and birds. That shows how the accumulated toxicity of pollutants ultimately find their pathways permeating all marine denizens. In certain areas even human mik has been found contaminated with DDT. The pathways, thus, of the pollutants to man are rather infinitesimal, originating either from terrestrial, atmospheric or marine bi ocycles (environment).

Unique Quality of Certain Marine Organisms

The sea offers the greatest intimacy between it and its organisms. We must always keep in mind this fact. Some marine organisms are quite capable of concentrating elements found even in trace amounts or minute quantities from sea water in their body tissues. The algae, particularly the sea weeds, concentrate iodine and the ascidians (Protochordates) are known to concentrate vanadium and the radiolarsian, family (Protozoa) Acatharidae, strontium. There are many such examples. The diatoms, forming the rich pasturage of the sea (belonging to the plant kingdom of the sea: phytoplankton), has a body concentration of silicon about 40 thousand times as great as ocean water itself. Upon these diatoms—the herbivorous zooplankton and upon them the carnivores—are linked as successive trophic tiers. It takes about 5 to 10 links in the food chain as it leads or ends up in man.

The hazards due to oil pollution are well known. The famous *Torrey Canyon* diaster, *Santa Barbara* and the recent *Amono Cadiz*, *Elaln* V, *Christos Bitas*, *Litiopa*, *Andos Patria*, *Esso Bernica* and many other incidents are noteworthy. The splitting of the tankers, or their collision against rocks in the sea, or their stranding, or getting caught in the mids, of a hurricane, monsoon, typhoon, or simply being stranded at mid-sea due to steering failure, or due to swift currents, or encountering "dead water", cause such of these failures—resulting in the discharge of their oil to the sea.

The large pools of oil, including ship washings, discharged into the sea threaten not only bird life as the oil reaches the shore, but also the entire pelagic and demersal food-web including fisheries. Hence the marine biota are always exposed to such risks.

Quantum of Oil Pollution

It has been estimated that the oceans annually receive some 3.3 million tonnes of oil (1980 data), of which 1.5 million tonne alone came from ship, 1.7 million tonne from onshore activities (including 1.3 million tonne of thrown away lubricants), and 0.08 million tonne from offshore exploitation and exploration of petroleum activities. The unexpected spill-out of cil to the sea due to petroleum field "*Ekofish*" blowout on the Norwegian sector of the North Sea in 1977, exactly ten years after the oil tanker *Torey Canyon* disaster in the North Sea (this time nearer the British Isles), are still fresh in memory.

International Responsibility

It is worth recalling that the 1972-U.N. Declaration of Human Environment (Stockholm) Conference proclaimed *inter alia* that, "states shall take all possible steps to prevent pollution of the seas by substances that are liable to create hazards to human health, to harm living sources and marine life, to damage amenities or to interfere with the other legitimate uses of the sea".

Furthermore, it adds, ". . . in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or of areas beyond the limit of national jurisdiction." It has to be admitted, however, that the strict enforcement of international convention for Prevention of Pollution from Ships (MARPOL), rules and regulations may present difficulties because of technical requirements. Many States will find it difficult to agree to its jurisdictional control.

Although oil pollution constitutes the biggest single threat to marine environment, in recent years nuclear pollution of the marine environment threatens to assume alarming proportions, with the mad rat race of nuclear proliferation of strategic arms and weapons and warheads. The sources may be listed as follows:

1. Nuclear-powered vessels discharging radioactive pollutants.
2. Disposal of radioactive matter in the sea.
3. Testing of thermonuclear devices and nuclear reactor disposal of wastes to the adjoining marine environment.
4. Contamination due to land-based sources of supply of materials.
5. Accidental discharges to the sea (as happened recently to the nuclear plant at "Three Mile Island, U.S.A).

The U.N. Conference of 1972 on Human Environment (Stockholm Habitat Conference) has also emphasised that the States should take possible steps to prevent pollution due to the dumping of hazardous matter in the seas. As a follow up, the London Convention (Prevention of Dumping of Wastes and other matter in the Sea) and the Oslo Convention (Prevention of Dumping in the Sea from Ships and Aircrafts) were concluded. The London Convention also takes care of radioactive marine pollution. The origins of marine radioactive pollution go back to July 1946 when USA commenced testing of nuclear weapons on Bikini Atoll in the Pacific Ocean. However, serious consequences came to light only with subsequent testings, when in 1954 a similar testing was carried on Marshall Islands. Some 84 islanders were affected due to faulty calculation "danger zone". The crew of a Japanese vessel situated 14 miles away from the warning zone—were also injured and one died. The U.S.A. paid 2 million dollars as *ex gratia* payment to Japan, although she did not admit liability. The origins of marine coastal radioactive pollution, one may say, started even much earlier, in 1945, when the first two atom bombs were dropped on the coastal cities of Hiroshima and Nagasaki.

Need for Protection of the Marine Environment

Opinion is divided on the legality of testing of nuclear weapons in the common seas. The principle of freedom of seas for the common good of manking should be understood by the States in its broadest sense and in its true spirit.

The instances of degradation of the marine environment due to injudicious land management are legion. The coral reef environment, the coastal mangrove forests environment and the atoll-lagoon environment are often spoilt and degraded by man. Even remote island arcs not spared. The construction of fishery harbours at the risk of sacrificing environmental quality, dredging of sea-ports and ore-handling harbours, reclamation of forest lands, adjacent to the coastal belt for recreational uses, housing and industrial activities are among the many examples of marine vandalism. The discharge of sewage, sugar-mill wastes from the Hawaii Isles, the Caribbean Isles, and Indonesia, and eutrophication aspects are often neglected in the protection of the marine environment. The effects of marine mining, discharge from large scale desalination plants established upon coastlines, impact of pollution products from the shore-based thermal plants, the impingement of atmospheric pollution upon sea, and the pollution due to maritime trade are the many aspects that deserve serious consideration in any comprehensive study of marine pollution. The WASH-1400, the Rasmussen report, NRC Risk Assessment Reviews—are all aimed at safety of nuclear reactors, minimising risk of accidents and chances of nuclear pollution.

Ocean Education as a Future Global Strategy for Protection of the Marine Environment

The marine environment needs protection from further injudicious uses. A public policy needs to be developed in each country on the lines of U.N. Stockholm Conference for efficient implementation. The study of ocean environmental management programme at the school and university levels is a must at this critical juncture. This study will promote academic interest in the marine environment. It will help in a study of baseline monitoring of pullutants, their concentration and degree of spread in the environment. It will promote an enlightened public interest in marine affairs. It will also strengthen the "Law of the Sea" framework as between nations, as our future generations will be exposed in such a scheme of study to a global concern of the environment and for a responsible development of ocean-conscious outlook and vision.

References

Hood, D.W. (1971), (Editor), Impingement of Man on the Oceans, pp.738, Wiley—Interscience, New York, (The various articles in this edited work).

Cusine, D.J. and Grant, J.P. (1980), (Editors), The impact of marine pollution, pp. 324. (The various articles in this edited work).

Ferguson Wood, E.J. and R.E. Johannes, (1975), (Editors), Tropical marine pollution. pp. 192 (The various articles in this edited work), Elsevier Oceanography Series 12, Elscwier Scientific Publishing Company.

Jerome Williams, (1979), Introduction to marine pollution control, pp.173, John Wiley and Sons, New York.

Pratt, J.W. (1974), (Editor), Statistical and mathematical aspects of pollution problems, pp. 392, (The various articles in this edited work), Marcel Dekker Inc., New York.

Sverdrup, H.W. Johnson, M.W. and Fleming R.H. (1942), The Oceans: their physics, chemistry and general biology, pp. 1037, Prentice-Hall, Englewood, Cliffs, N.J.

Teaching-Learning Strategies for Environmental Education

J.S. GILL*

Introduction

Education is a powerful means of transfer and percolation of knowledge and the educational programmes as such should meet the fast changing demands and expectations of the society from time to time. The expanding knowledge of science and technology accompained by fast growing environmental problems has set in motion the updating of educational curricula to meet the new challenges and preparing the environment consious citizens. Moreover educating the people particularly the young minds about the environment and its related aspects helps to link the learning process with daily-life—experiences thus making it more meaningful. The environment, as all would agree, is also a potential source of teaching-learning situations and provides sufficient scope for making pupils environment concerned.

The general objectives set out for environmental education in Belgrade charter (1975) related to environment are *awareness, Knowledge, skills, attitude, evaluation, ability* and *participation.* These are exactly what is intended in science teaching at present. In no may environmental education is alien to the teacher. Both science education and environmental education aim at broader educational achievement beyond the more acquisition of knowledge.

Keeping in view the new role and expectations in respect of environmental education the educational curricula especially in schools have been under going changes. The latest shift towards environment has given new emphasis, approach and dimension to the curriculum. Attempts have been made to make the teaching-learning process environment *based* and environment *biased.* The curricular changes including the present one unfortunately are occurring so frequently that only a few of the educational innovations have been able to get an actual foothold in the educational system—more so in the schools. The extent of assimilation of these innovations are more in imagination and talk rather than in practice. Inspite of the best intention and efforts with limited resources (both academic and financial) most of the developing nations have not been able to cope up with the changes. Over and above this the agencies involved at various levels in fulfilling the curricular needs could spare little attention to follow up the fate of the innovations in the working of the school system. These experiences definitely are caution mark for the functionaries involved in designing and implementation of environmental education programmes.

---

*Department of Education in Science and Mathematics, National Council of Educational Research and Training New Delhi.

Curriculum Development

It may be of help later in dealing teaching-learning strategies in this paper if one realizes their locale and importance in the total process of curriculum development.

The selection and organization of method in the process of curriculum development is an important and among the four fundamental steps and can be represented by a simple illustration of model of nicholls and Nicholls, 1978[2] (Fig.1). These steps are important for effecting a curriculum to bring about the desired changes in pupils. All the four steps are interrelated and interdependent and it is difficult to visualise any one of them in isolation. The selection of appropriate strategies and teaching methodologies helps in achieving the given objectives through the identified relevant content. The two components of curriculum, objectives and content, have been changed and updated from time to time without effecting simultaneous changes in the component of teaching strategies with matching pace. In case of present emphasis on environmental education the stress on teaching-learning strategies is quite encouraging. In this country the general practice had been to identify the content (syllabus) and suggest suitable strategies for transfering content to pupils through the materials like teacher guides.

Teaching Strategy

Teaching strategy is providing an experience or situation for imparting desirable knowledge, skills, etc. It is employed to achieve the objectives through an appropriate content.

The teaching methodology step in the curriculum directly concerns the class room, the teacher being a central figure should be involved at

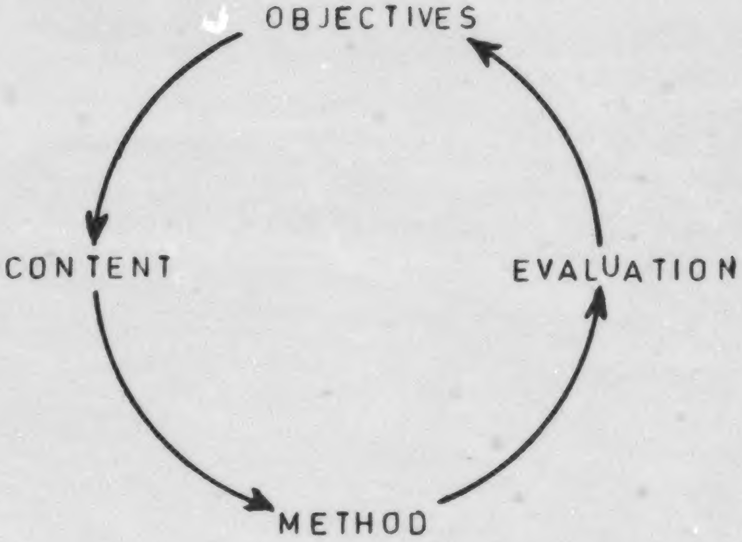


FIG.1 STEPS IN THE PROCESS OF CURRICULUM DEVELOPMENT

the designing stage of the curriculum for its successful implementation. The teacher without a idea of a appropriate strategy is like a worker without a tool. It also encourages the teacher to adopt wrong method and thus loosing the spirit of teaching learning process.

A number of teaching models are available for teaching various disciplines (Joyce and Weil, 1979[3], Meyor 1980[4]) gave the effectiveness index to various teaching methods after trying out effectiveness of each in achieving the specific aims of biology teaching. A few attempts have been made to summarize the strategies being practised in environmental education Programmes (Wolsk, 1975[5]). There is urgent need of establishing the efficacy of the available teaching strategies in respect to the emphasis given on the environment in the curricula. Regional workshop (1980[6]) has suggested the suitable strategies for specific, environmental content being taught in schools of Asia. These are expected to be employed by the teachers in addition to the basic competencies.

Curriculum designers in the developing world though claim to have succeeded in giving environmental dimension to the curriculum will have to go a long way for providing suitable teaching-learning strategies and methods for realisation of the objectives.

Teachers and Teaching Strategies

The teaching of environment based and environment related components demands more on the part of teacher in terms of involvement than were conveyor of knowledge (Fig. 2). There are number of strategies (see Appendix) available for teaching of science. Some are being practised in teaching of environmental components included in the existing curricula. The adoption of any strategy besides others depends on the following factors.

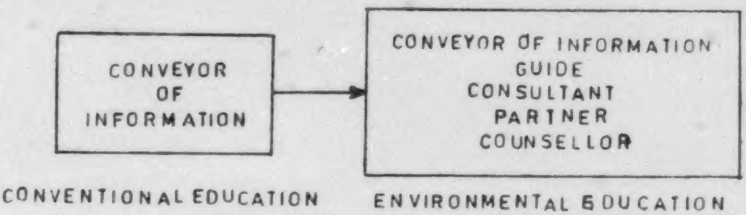


FIG. 2 ROLE OF TEACHER

1. awareness of the teacher
2. teacher's personal experience with the strategies
3. background of the learners
4. availability of resources

Generally the teachers overlook various factors and resort to single method forgetting the effectiveness of teaching as well as extent of achievement of the pupils.

Some experiences gained during the training programmes for teacher educators and teachers provide a basic information given below:

(a) Majority is not aware of the available teaching-learning strategies.

(b) Some others are aware of the strategies but have not tried themseleves.

(c) Rest of them are enthusiastic and aware of the strategies but are not able to try due to the limitation of time, materials and large number of students, The information obtained during the contact with groups of teacher educators about the various teaching strategies presently practised by the teachers at secondary/higher secondary level can be categorised based the frequency of use of strategy (Table 1). These are listed in order of practice under each column.

TABLE 1

Categories of available teaching strategies based on their use

Most common practice	*Less common practice*	*Rarely practised*
Lecture	Group discussion	Buzz session
Use of charts	academic games	symposium
Question-answer	use of cards	Debate
Laboratory	Panel discussion	Use of experts knowledge
Field trips	Use of audiomaterials	Role play
		Brain storming

The teachers generally try the following combinations of strategies based on the content:

(a) Lecture-chart

(b) Lecture-living organisms

(c) Question-answer-discussion

(d) Field trip-group discussion

Some of the teaching strategies like buzz session, role play, brain storming, panel discussion though advised by the experts are not employed as the teachers are not familiar with them.

Another feature noted was that the background, psychological development, requirements and experiences of the children hardly play any role with the teacher for selecting a strategy.

There is a need to convince the teachers that there is no single multipurpose strategy for teaching different concepts. The ideal combination of different strategies has to be found out and tried for achieving the objectives set.

Most commonly adopted is the lecture at all the levels of schooling. The teacher has little information with him and students also take time to collect the information either from textbooks or from other sources. Therefore teachers should take pains to collect and compile the information on environment from the available sources. With ltittle amount of preparation teacher can make the otherwise considered lecture method more interesting and effective.

Primary school teachers under the environmental studies curriculum of NCERT generally adopt teaching-learning strategies like observation, collection, dialogue, project work and field trips. More have been suggested for teaching of science at this level (Report—1979[7]).

The teachers at Secondary and higher secondary levels also resort to other strategies like project work, discussion, symposium, use of experts knowledge in addition to lecture, discussion and field work, some of the teachers resort to group investigation method. For example exciting environmental problems are raised by students either from their personal knowledge or teacher intiiates them. It is discussed in small groups where the participants give their reactions to formulate the issue. The reactions are recorded by the teacher and the class with the help of teacher evaluates the reactions in relation to the environmental problem.

Some of the strategies given below were tried in the training programmes for teacher educators and teachers and were found to be interesting and useful to the teacher learners.

Buzz Session

The topic of conservation was introduced to the participants through newspaper cuttings. Each news item was discussed in group of four (by convenient seating arrangement). The groups presented the information to the bigger group after 3 or 4 minutes. The points were recorded and listed sequentially as nature and its resources, their use, conservation, efforts of the individual, governmental and international agencies.

Use of Information

A lot of information on environment is available in newspapers magazines, T.V. programmes and radio talks. Other popular hobbies such as philately can also be used to initiate and impress the environmental topic in the class room. Stamps were also tried as an aid for group discussion and question-answer sessions. The information available in stamps, Ist day covers and folders on plants, animals (butterflies, birds) and particularly on wild life was distributed to the participants. The person with stamp on 'tiger' provides environmental aspects of it for discussion. Similarly the idea of flora and fauna of India was brought in.

Field Work

It is a strategy reluctantly adopted by the teachers. It involved many factors like time available in the time table, management and resources. A well planned and worked out field trip helps in optimising the educational output.

Ecology plays an important role in environmental education programmes. The basic ecological concepts can be effectively conveyed through simple ecological techniques (Gill 1981[8]).

During one of the try out a quadrat was laid in the field and related terms (population, community, ecosystem, producers, consumers, etc., were discussed and clarified, there itself in the field. Though it is time taking but helps in imparting environmental information, for example, basic skills like mapping, survey, sampling and collection of ecological data.

In view of the above experiences, it is felt that following strategies provide stimulating and motivating teaching learning situations.

1. Teaching through field work
2. Buzz session
3. Use of information (for buzz session, brain storming and discussion
4. Role play
5. Use of experts knowledge

Although most of these teaching strategies are known to the trained teachers but there are some impediments for their use in the classroom.

Some Inputs

The teachers in their pre-service training get the experience of different teaching strategies. The factors like non-familiarity, crowded classroom, other assignments and variety of new content make it difficult for teachers to employ various strategies in the class-room. Summer institutes were organised for inservice training of teachers. Unfortunately subject experts acting as resource persons paid were attention to conveying of content rather than methodology, during these programmes.

At present various available strategies are being tried in enrichment courses regularly organised for teacher eudcators by DESM, NCERT, New Delhi and also in the teacher training programmes of other agencies. The intention is to create awareness and also give experiences and familiarity to the functionaries like teacher educators/key persons responsible for teacher training in the states with a multiplier effect in veiw. The training of actual class-room teachers is a massive task and agencies involved will have to strive hard.

Suggestions

1. Pre-service training programmes should be strengthened with environmental components not only in content but also in methodology. It helps in designing and development of appropriate teaching-learning strategies.
2. In-service training should be related to actual contents and topics of environment covered in curriculum. The teachers will get an opportunity to learn and make themselves familiar with relevant strategies to be adopted for successful teaching.
3. The specific objectives based on content related to environment must be defined and conveyed to the teachers so that they adopt a suitable teaching strategy to achieve the same.
4. Researches should be undertaken to establish the efficacy of various available teaching strategies, especially for science, as per the local needs and resources for imparting environmental education. For example keeping in view the limitations the countries like ours cannot afford to go far strategies like computer-assisted instruction.

Acknowledgement

I am grateful to Dr. D. Lahiry of DESM, NCERT, New Delhi for providing constructive criticism and suggestions. I am also thankful to

NCERT for deputing me to this conference and to the organisers for giving me an opportunity to present my views.

References

1. Workshop on Environmetal Education 1975, Belgrade.
2. Nicholls, Andrey and H.J. Nicholls 1930: Developing a Curriculum —Practical Guide, Georgle Allen, Great Britain.
3. Joyce Bruce and Marsha Weil, 1972: Models of teaching, Engelwood cliffs, New Jersey, Prentice Hall.
4. Meyer G. Box, 1980, Alternative strategies including methodologies for teaching-learning of Biology at school level for relevant and appropriate skill development for every day life, UNESCO.
5. Wolsk, D. 1977, Methodologies of environmental education, Trends in environmental education I-35-48, UNESCO.
6. Report 1980, Regional workshop on Biology Education in Asia, UNESCO.
7. Report 1979, Teaching-learning strategies at the primary stage working group meeting, NCERT, New Delhi.
8. Gill J S. 1981, Ecological techniques in environmental education— A need, paper presented at international conference on Environmental Education, Udaipur, Rajasthan, India.

APPENDIX

Available teaching-learning strategies

Lecture
Use of charts
Question-answer
Laboratory
Field trip
Group discussion
Panel discussion
Debate

Use of audio-materials
Academic games
Use of information
Buzz Session
Brain storming
Symposium
Role of play
Use of experts knowledge.

Social Fencing and Institutionalisation of Green Gold Farming in the Himalayas

P.R. MISHRA*

Introduction

What education will solve the increasing problem of rural poverty and rural un-employment while solving the problem of increasing hill denudation will continue to remain an ever renewable environmental question demanding urgent solution not only before a poor country like India but before several other developing countries of the World? What kind of education is really needed for inhabitants of fragile Himalayan ecosystem where a delicate balance exists between what the hilly environment can provide without deteriorating and what the society needs to make out a reasonable living? Our present education is not only producing pupils for white collar jobs but also increasing their wealth absorbing desires. They do not possess wealth increasing power in a difficult environment. No wonder, they prefer to sing sweet songs of environmental pollution threatening the poor rather than developing competence to help them as to how they can produce the most while wasting the least and attempt to show a new path of living with pride and not with any sense of guilt in the Himalayan ecosystem.

It is the lack of the above type of education that is compelling us to witness as idle and helpless spectator the increasing battle between poverty and hill denudation each complementing the other. While the poor are capitalising political power for freedom to graze and freedom to remove sparse vegetation cover, the hills are capitalising natural power of slopes and intense rainfall for awakening the nation through visual problems like eroding hills, silting tanks, increasing hardships to the inhabitants who have to travel several miles now just for a bundle of leaf fodder or fuel, large volume of precious rainwater getting wasted from large areas, conversion of useful perennial streams into reasonal devastating torrents and above all the increasing social tension in the hills.

---

*Officer-in-Charge, Central Soil and Water Conservation Research and Training Institute, Research Centre Chandigarh.

The paper describes as to how the concept of social fencing and social synergy when tested in an extremely hostile hilly environment, generated huge amount of social wealth and became a visible tool to ensure long range environmental productivity. Various models of environment degradation, importance of ever green farming system and the urgent need of linking education with long range environment productivity have been discussed.

Social fencing and social synergy—Swaminathan, M.S., in 1973 in his Patel Memorial Lecture advocated the concept of social synergy, where "the individual by the same act and at the same time, serves his own advantage and that of the group". Citing the example of symbiosis or the process of mutual assistance, he noted a close correlation between synergy and non-violence of Mahatma Gandhi and desired that the said concept be used for maximisation of benefits and minimisation of hazards.

"Social fencing", in fact is a product of social synergy. I would like to explain the social and physical environment of a village called Sukhomajri, where the concept was tested. The villagers were professional graziers and there was a race between the society determined to strip vegetation from the hills to make out a living and the hills determined to demonstrate a model of national disaster and to penalise the society. Naked hills having countless gullies, low land holding, low farm income, increasing dependence of the society on far flung hilly areas for grazing, lopping and fuel to suppllement farm income, not a single farmer using fertilizer or improved seeds, a deep gully devouring agricultural fields, all combined together constituted an environment of denuding hills and desperate people in the village (Photos 1 and 2). Lack of faith of the poor on the so claimed scientific land use and their least concern about the fast silting of the luxury lake of Chandigarh, perpetuated a social environment of using land beyond its capability to manage a living. The plough had gone right up to the hill top and right upto the neck of a deep vertical gully in the village. The concept of using land according to its capability was crumbling down into pieces in the social court. The concept of demarkating watershed starting treatment from top to bottom was torn asunder because very powerful variables were sitting outside the wisdom of traditional concept of watershed management. What really is the social relevance of science in this village?

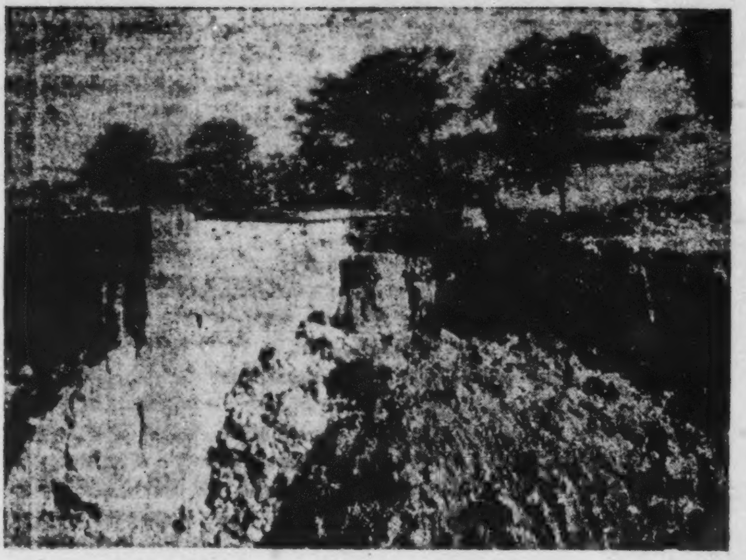


Photo 1. Deep gully devouring agriculture field.

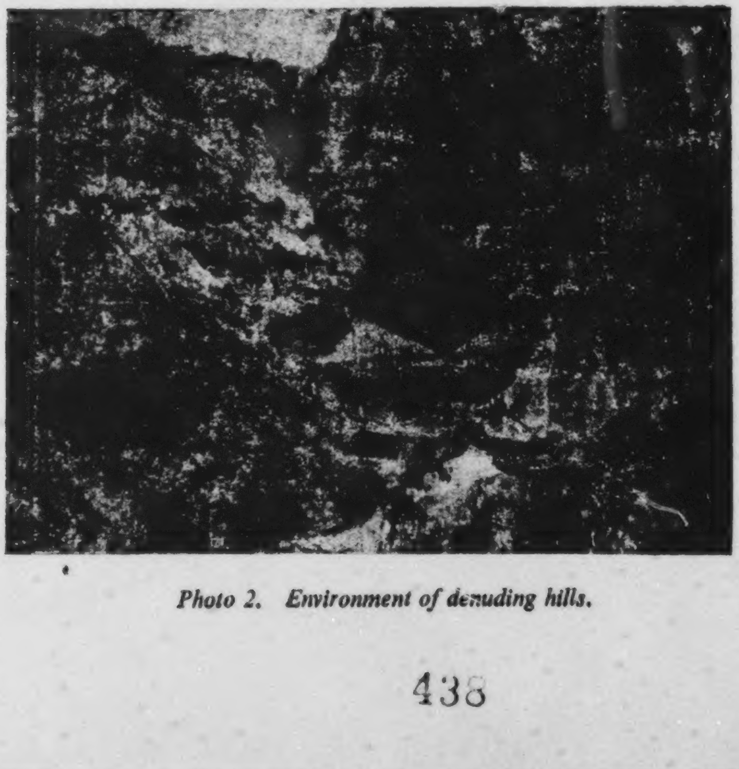


Photo 2. Environment of denuding hills.

Now the hills are socially and morally fenced. The same hilly tract which was yielding 300 tonnes of mud with 600 mm of flood flow and hardly a quintal of grass per hectare is now generating social wealth worth over Rs. 30,000 annually. No wonder, the entire burden of the protection of the hilly environment has been passed on successfully on the responsible shoulders of the poor farmers. No one of the village now resorts to grazing. Grass cutting now is the social law. Total stoppage of supplemental water to any one who violates is the social penalty.

The act of protecting the entire hilly area from grazing and resorting to grass cutting by the society is what I term as social or moral fencing. The social wealth that the society is getting now is from social fencing and social synergy. This is as under:

Summary of Social Wealth

S. No.	*Name of Wealth*	*Total (q)*		*Increase*	
		1977	*1981*	*Quintal*	*Amount*
1.	*Wheat*				*Rs.*
	Grain	250.1	1015.7	765.6	99,528
	Straw	500.2	2031.4	1531.2	30,624
2.	*Maize*				
	Grain	356.5	552.5	190.0	23,520
	Stalk	463.5	718.3	254.8	3,058
3.	*Milk*	2193.6	4405.5	2211.9	5,52,975
	Total	—	—	—	7,09,705

The hills are the same and so are the people. But their relationship is dramatically changed. What really is the protective value of the model? The sediment rate in Chandigarh lake is reduced now by 90 per cent. Does it have a monetary value? What really is the economics of social fencing and social synergy? Does the problem lie on the hills or in the village? There will be no drought in the village. Does it have a value? Not a drop of water nor a particle of soil will go out of the experimental watershed (Photo 3).

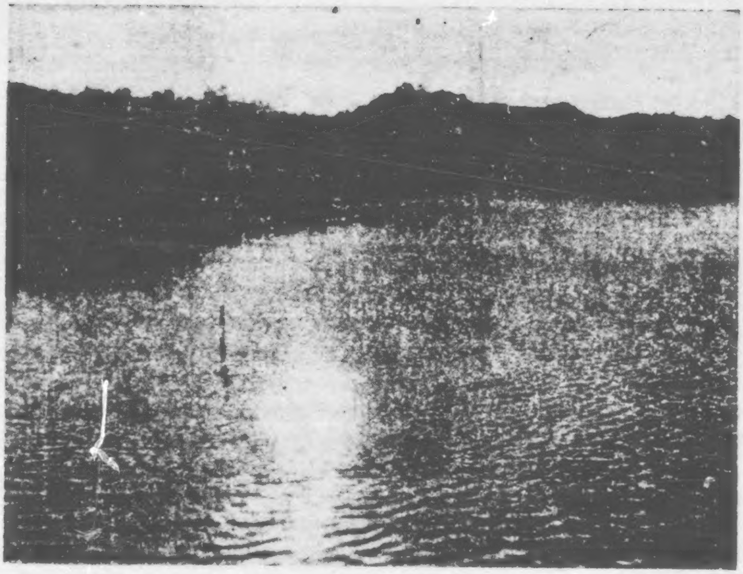


Photo 3. Reservoir—Insurance against drought.

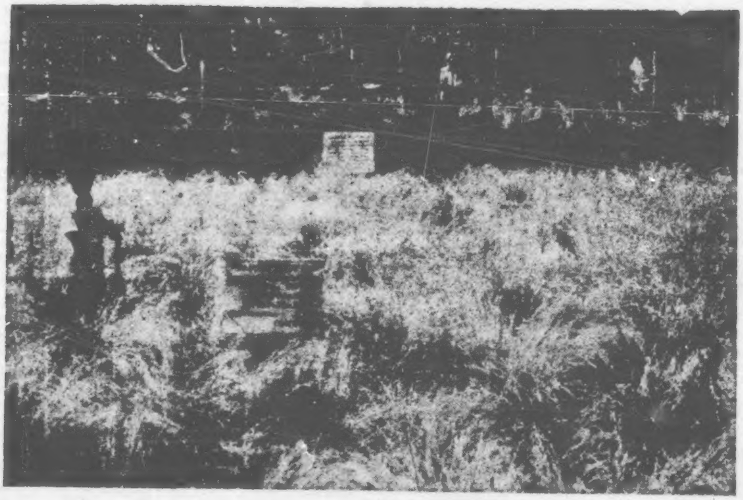


Photo 4. Bumper crop of Bhabbar grass—source of employment generation.

If the average per capita annual income of India is Rs. 300/-, does it really mean that each hectare of eroded hill of the village can yield such income to 100 people? Is this the potential? What really is the social, economical, scientific, environmental and moral value of the model? Does the model possess a built-in bias in favour of the poor and in favour of the hilly environment? Does the model provide the first lesson to be learnt by heart by everyone who feels and talks about the threat to hilly environment? The physical fencing with stone or barbed wire in fact is a wall of distrust between the society and the Govt. These are broken by the villagers. These are resisted. Political support is sought for providing free grazing facilities in afforested areas.

Let us now go to fast deteriorating Himalayan ecosystems which I did have the fortune to witness very recently in the state of U.P. Large areas are lying idle with very little productive value. Grazing by uncontrolled cattle in the hilly areas is presently providing an extremely high risk farming system in the hills. The hill people at present are able to produce food hardly for three months and they are surviving by money order. Bhimtal, a natural lake is silting up at alarming rate which is rather visible. Hundredc of tonnes of boulders per ha. have started coming down from surrounding hilly areas. It is estimated that the Ramganga project would last only for 48 years.

No one, it appears, feels concerned about improving the lot of the people within the quickest possible time so as to minimise the sediment rate which is entirely a social product. The hard earned lesson of Sukhomajri proves it provided of course we are willing to learn the grass-root environmental problems. The existing concept of watershed management is not indigenous. It is reservoir oriented concept and never people oriented. How long can we afford to talk in sound proof compartment where one does not understand the language of the other? The ultimate destiny of the hilly environment lies in social fencing and the key lies with the society or not with the scientists, technologists, educationists or administrators. The society will hand over the key because it is ready to increase social income from green gold of useful grass and trees and the green guards are ready to protect the critical environment.

What really is the per capita rainwater wealth available and what wealth with what scientific principle is being generated? If we attempt to harness productive wealth from the rainwater with existing knowledge available in the country scattered in different laboratories available, we will have neither environmental problem, nor problem of rural poverty.

Now I will attempt to support my above statement, through my proposal of institutionalisation of green gold farming.

Institutionalisation of green gold farming:

Before I proceed further I would like to make a few more statements based on practical work done relevant to the subject. In the same environment under similar slope and soil only by restructuring the natural vegetation cover complex it has been possible to release visible water 5 mm to over 500 mm per hectare of hilly area. There is absolutely no question of making any doubt. This is a field model available to be seen by any environmentalist. This leads us to two clear conclusions. First the knowledge for reducing flood and sedimentation hazards is available and the second large changes in reducing or increasing runoff depending upon our social need are possible by restructuring the plant communities. Another conclusion relevant to the subject is generation of employment worth Rupees twenty thousand per hectare of eroded land only from grass. The land-less have already started gaining income in Harijan Nada where only 2.6 ha agriculture land is available having 104 human beings and 52 cattle. If we also add income from water through recycling in the eroded land itself, I have least doubt that the hills will generate much more income and employment per unit area and time than un-irrigated agriculture where the poor are struggling only to multiply the problem of hill denudation.

Just within a period of 9 months 112 tonnes of green biomas of koo Babul (Kg) could be made available. Does it not indicate over 12 tonnes production of green gold per month? What really the society needs after all?

Just a plantation of Sissoo (Dalbergia sissoo) produced 32 tonnes of utilisable fuel per hectare per year with close planting. Does it mean fulfilling fuel need of 16 families? A smokeless Chulha saved 40 per cent of fuel consumption (Photo 6) Does it mean reduction of 40 per cent consumption and thereby 40 per cent reduction of pressure on hill for fuel by one stroke? Production of five tonnes of *Eulaliopsis binata* a commercial grass could be made available under Eucalyptus planted 2 metre apart. With 80 per cent recovery 4 tonnes of rope has been manufactured giving a social income of Rupees ten thousand only from grass. Just one tree of pine produces Rs. 18 worth of Lisa annually. If a farmer is having only 500 trees, he can get annual income of Rupees nine thousand excluding the price of the trees. One pine tree can yield over two truck loads of fuel from side branches leaving the value of timber. And what really is its value as finished product?

Photo 5. Social Employment—conversion of grass into cash.

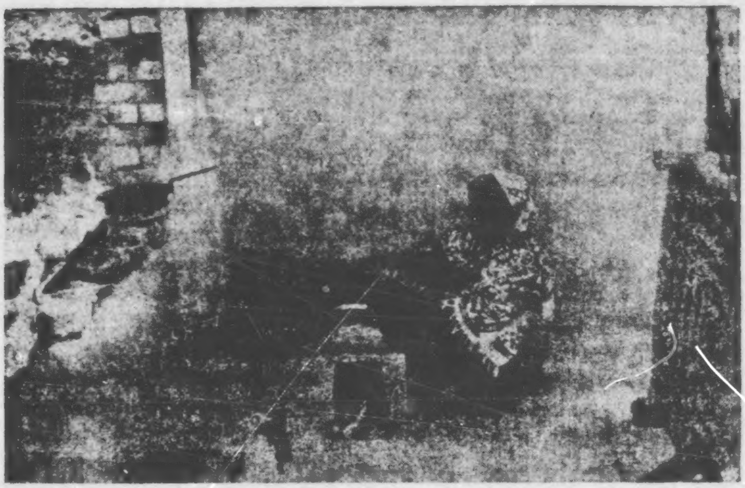


Photo 6. Smokeless chulha—40 per cent saving in fuel.

Economically profitable and ecologically suitable, is it not amazing why this green gold is not socially acceptable? The reasons are not far to seek. The hill farmers are neither producers nor manufacturers nor are in a position to derive any money from the skill of what the society calls business. It is the ripe time to realise that the tree farming has to be made acceptable to the society and in that case, the people will minimise the number of cattle that they have to keep for unprofitable agriculture.

It is the ripe time to institutionalise the green gold farming programme. Every school must have a tree farm laboratory of about 100 hectares which should generate a minimum annual income flow of about Rs. 8 to 10 lacs to meet the entire expenditure of the school including the mid-day free lunch to every boy and girl. 75 per cent of the teaching course should include production technology for green gold farming, including fruit plants, rasin tapping, making wooden trays, toys, small saw milling, honey making, mushroom cultivation, chip board manufacture technology, nursery technology, improved logging technology, fruit packing, jam making etc. The teachers of this institution must be highly paid personnel.

The primary goal of the institution should be to link up education with productivity of the environment, to establish the loosing link between conservation of the environment and production. The research wing of the institution should be very strong. Research should open up new horizon in improving production technology, seasoning technology, for saving fuel energy with improvised chulha, technology for using solar energy, technique for small hydel power and many other innovations related with conservation and production. The feeling of inter-dependence of man with the hilly environment must be inculcated with practical work in the mind of boys and girls. After such education, they need not think of accepting any white collar job. The function of the institution would be to produce highly competent persons trained to produce the most and waste the least. 50 per cent of the time of the boys and girls should be devoted in physical work related with production, processing, disease and pest control, nursery technique, raising medicinal plants of high economic value, work in wood based and fruit based industries etc., so that such individuals may not have to see books to do a job. Increasing job opportunities should be the goal of research.

I would like to explain the missing link between production and manufacture by an example. Let there be a small match wood factory exclusively under the charge of the Principal of a high school who will teach both the improvement in production technology for growing more and more poplar per unit area per unit time and also improvement in manufacture technology of match wood. The Principal will soon discover differential wages for his two types of pupils, one engaged in producing and the other engaged in manufacturing. The Principal will know for certain that just one hectare of poplar plantation generates wealth in the form of match worth several lacs of rupees. The Principal as impartial judge will try equitable distribution to various participants who will be his students only.

Recommendation

The following recommendations emerge from the foregoing discussion:

1. In view of increasing problem of poverty and hill denudation going unabated an institution of National or International importance be created with primary responsibility for developing ways and means for improvement and restoration of human environment in the hills with a number of sub-centres with similar responsibilities.
2. All programmes related with raising of trees and grass including processing and manufacture of various goods therefrom and also from forests be institutionalised.
3. The farm and factory of the institution should aim to generate entire institutional expenditure to serve as a model for the boys and girls as to how productive employment can be generated without deteriorating the hilly environment.
4. The institution should have strong research wing primarily with the responsibility of increasing job opportunities through research in production, manufacture and marketing.

Reference

1. Swaminathan, M.S., Our agriculture future, 1973.

A Study of Environmental Awareness among Children of Rural and Urban Schools and Non-Formal Education Centres

V.K. GUPTA, J.S. GREWAL and J.S. RAJPUT*

Introduction

It is by now well appreciated that formal schooling is not a solution for the universalisation of elementary education in India. Alternative strategies of providing education in a way convenient to the children and their parents have very recently been thought of and are being tried. The imparting of education to the non-school going children and drop-outs in the non-formal education (NFE) centres is one such alternative. National Council of Educational Research and Training, India has opened 228 NFE centres in the country through its four Regional Colleges of Education and Field Offices on an experimental basis for developing a model for non-formal education. State Governments have also initiated such efforts for the universalisation of elementary education. Apart from these agencies, some voluntary organisations are also working in this area.

The basic objective being to develop a suitable working model suiting to the needs of different target groups. Consequently the question of curriculum construction for these children needs careful attention. Can we have the same curriculum for all such children? The environment in which the children are living and studying plays an important role in learning.[1–4] Considerable differences already exist in the environment of rural and urban children. Such areas of differences are to be identified. It was with this view that the present study of identifying the different aspects of the environment was undertaken, the objec-

---

*National Council of Educational Research and Training, Regional College of Education, Bhopal-462 013, India.

tive being to know components of environment in which children from rural and urban areas are lacking and the areas in which the students from both the streams are well acquainted has been taken up. This comparison has also been done with the children studying at NFE centres. It was felt that this study would be helpful while framing the environmental-based curriculum for universalisation of elementary education.

Sample of the Study

The study was conducted on the children of class IV of different schools situated both in rural and urban areas. From NFE centres, those students were included who had reached level of class IV. For rural stream, different schools of Narsingarh block of Rajgarh district in Madhya Pradesh were selected where some of the NFE centres of NCERT are functioning. For urban stream, some schools of Bhopal city were selected. In this way the study has been conducted on three groups —(i) Formal Rural (FR); (ii) Formal Urban (FU); and (iii) Non-formal Rural (NFR).

Tool Used

For measuring the awareness of the children towards their environment, a standard environmental questionnaire developed by Rajput and associates[5] with minor modifications was administered to the students of different groups.

Methodology

Twenty students studying in class IV in formal rural schools, 35 students studying in class IV in formal urban schools and 60 students studying in group C in different NFE centres were randomly selected. Group C in NFE centres is almost equivalent to class IV of the formal schools. The environmental questionnaire was administered on the children of different groups included in the study. The differences in the achievement of the students of different groups on knowledge of their environment were calculated by applying the t-test. The performance of the students of different groups was compared with each other. Analysis of students' performance on all the fifty questions of the environmental questionnaire was also done and each question was ranked in terms of childrens' performance. First ten and last ten ranking questions from each of the three groups were identified and compared with each other. In this way some aspects of knowledge of their environment were found to be common in each group and certain such areas were also identified in which the three groups differed from each other.

Results and Discussions

5.1 *Comparison of Environmental Knowledge of Formal Urban (FU) and Formal Rural (FR) groups*

The number of subjects, the mean scores, S.D. and t-value of these two groups are shown in Table I.

TABLE I

Comparison of FU and FR groups

Sub-groups	*N*	*M*	*S.D.*	*t*
FU	35	32.54	8.30	2.30*
FR	20	38.70	6.93	

$^*p<0.05$, df=53

The t-value indicates that there is a significant difference in the performance of the subjects of these two groups on their awareness towards the environment. Evidently this difference is due to difference in their environment. This is further supported by the ranking of questions of the environmental questionnaire. On this questionnaire, differences were found in the first ten ranking questions of FU and FR groups, though some questions were found to be common amongst the first ten ranking ones as indicates in Table II. Out of first ten ranking aspects the students from FU group could do better on the aspects of: the intensity of heat of moon, sun and earth; source of grains like gram, wheat, etc.; edible portion of the spinach plant; daily change in weather and the living place of the dog which was not observed in the FR group. On the other hand, the students of FR group scored more on such aspects as the direction of sunrise, source of getting wool, animals who do not eat grass and knowledge about the shape of the earth. However, the students of both the groups faired equally well on these areas such as: source of cotton, edible portion of tomato plant, idea about the physical characteristics of the newly born child, the animal who guards the house and the effect of weather on the growth of plants.

Common Aspects Amongst the First Ten

Both FU and FR faired almost equally well on the following aspects:

1. Source of getting cotton

TABLE II

Comparison of FU and FR on the basis of first 10 ranking aspects of the environmental knowledge.

Sl. No.	Environmental Aspects	Direction of Difference (+, —)	
		FU	FR
1.	The intensity of heat of moon, sun and earth	+	—
2.	Edible portion of the spinach plant	+	—
3.	Source of grains like gram, wheat, etc.	+	—
4.	Daily changes in weather conditions	+	—
5.	Shape of the leaves of different plants	+	—
6.	The living places of dog	—	+
7.	Direction in which the sun rises	—	+
8.	Shape of the earth	—	+
9.	Source of getting wool	—	+
10.	Animals who do not eat grass	—	+

+ means occurrence in the first ten.
— means absence in the first ten.

2. Edible portion of tomato plant
3. Physical characteristics of the newly born child
4. Animal for watching the house
5. Effect of weather on the growth of plants

Differences between FU and FR groups were also observed in the light of last ten ranking aspects as indicated in Table III. The students of FU group scored rather poorly in the areas of knowledge of directions, shadow formation, the importance of air for the flies to live and the uses of giving boiled water to the patients. These areas were not amongst the last tens in the case of students of FR group indicating that the students from formal rural segment have better knowledge about all these as compared to the students of the formal urban areas. The score of the students of FR group was found to be low in comparison to that of FU group in the areas of relationship between soil and rock, the role of bone skeleton for giving definite shape to the body, metals used for making a magnet and to see time in the watch. The reasons for some of them are quite obvious. What to talk of magnet? Most of the students of FR group, where the study was conducted, had not seen a watch thus accounting for the poor scoring in these areas. However, some of the weak areas were found to be common in both the groups. These were: prevention of rusting, application of knowledge regarding shape of the earth, knowledge of the direction of the wind, idea about the evaporation of water, why it is dark at night and relationship between rocks and stones.

TABLE III

Comparison of FU and FR on the basis of last 10 ranking aspects of environmental knowledge

S. No.	*Environmental Aspects*	*Direction of Difference* (+, —)	
		FU	*FR*
1.	Knowledge of directions	+	—
2.	Formation of shadows	+	—
3.	Importance of air for the flies to live	+	—
4.	Uses of giving boiled water to the patients	+	—
5.	Relationship between soil and rock	—	+
6.	Role of bone skeleton for giving a definite shape to the body	—	+
7.	Metals used for making a magnet	—	+
8.	Ability to read time in the watch	—	+

Common Aspects Amongst Last Ten

Both FU and FR did almost equally bad on the following aspects:

1. Ways of preventing of rusting of objects
2. Shape of the earth (application part)
3. The way of finding the direction of wind
4. Idea of evaporation of water
5. Relationship between rocks and stones
6. Reasons for the night being dark

5.2. *Comparison of Formal Urban (FU) and Non-formal Rural (NFR) groups*

The number of subjects, the mean scores, S.D. and t-value of these two groups are shown in Table IV.

TABLE IV

Comparison of FU and NFR groups

Sub-groups	*N*	*M*	*S.D.*	*t*
FU	35	32.54	8.30	3.30*
NFR	60	38.78	4.90	

$^{*}p<0.01$, df=93

The t-value indicates that there is a significant difference in the performance of the subjects of these two groups on their awareness of the environment. Further, the differences are in favour of the NFR group. The itemwise analysis as given in Table V indicates that the students of FU group have better understanding in these areas: the intensity of heat of moon, sun and earth, source of grains like gram, the edible portion of spinach and tomato, change in daily weather and the shape of the leaves of different plants. Their score in these areas was also found to be better when compared with the FR group as discussed in 5.1. On the other hand, the students of NFR group have obtained higher scores in the aspects of direction of sunrise, source of getting wool and the source of water which is safe for drinking. This is due to the fact that the livelihood of most of the children of NFR group in Narsingarh depends to a great extent upon goats and sheeps. They bring up these animals and they know that wool is obtained from sheeps. Similarly they are to face the problem of drinking water also in their daily life and they are to choose one of the sources of water out of well, lake and pond. Being well acquainted with their immediate environment they could score better. The students of both the groups could do equally well in knowing about the physical characteristics of the newly born children, effect of weather on the growth of plants, source of cotton and the animal used for watching the house because both the groups are acquainted with these aspects.

TABLE V

Comparison of FU and NFR groups on the basis of first ten ranking aspects

S. No.	*Environmental Aspects*	*Direction of Difference (+, —)*	
		FU	*NFR*
1.	The intensity of heat of sun, moon and earth	+	—
2.	Source of grains like gram, wheat, etc.	+	—
3.	Edible portion of spinach plant	+	—
4.	Edible portion of a tomato plant	+	—
5.	Change in daily weather	+	—
6.	Shape of leaves of different plants	+	—
7.	Type of water that is safe for drinking	—	+
8.	Direction of sunrise	—	+
9.	Source of getting wool	—	+
10.	Sources of water	—	+
11.	The birds who do not make a nest	—	+
12.	Shape of the earth	—	+

Common Aspects Amongst First Ten

Both FU and NFR groups did equally well on the following aspects:

1. Physical characteristics of the newly born child
2. Source of getting cotton
3. Effect of weather on the growth of plants
4. The animal used for watching the house

Difference between FU and NFR groups were also observed in the light of last ten ranking aspects as done 5.1 and are given in Table VI. It is evident from Table VI that the performance of the students of NFR group was poorer in the areas of: rotation of the moon round the earth, relationship between rock and soil, the role of bone skeleton for giving a definite shape to the body and to read time in a watch. Some of these areas were also observed in FR group. The reason being that the environment of the children of FR and NFR groups is same, the only difference being in their way of getting education. With one or two exceptions, most of the last ranking aspects in these two groups were also found to be the same as already observed in the case of FU and FR groups as discussed in 5.1.

TABLE VI

Comparison of FU and NFR on the basis of last 10 ranking aspects

S. No.	*Environmental Aspects*	*Direction of Difference* (+, —)	
		FU	*NFR*
1.	Knowledge of directions	+	—
2.	Reasons for being dark at night	+	—
3.	Relationship between rocks and stones	+	—
4.	The importance of air for the flies to live	+	—
5.	Rotation of moon round the earth	—	+
6.	Relationship between rocks and soil	—	+
7.	The role of bone skeleton for a definite shape of the body	—	+
8.	To read time in the watch	—	+

Common Aspects Amongst Last Ten

Both FU and NFR students did equally bad on the following aspects:

1. Preventing of rusting of objects
2. The reason for giving boiled water to the patients
3. Shape of the earth (application part)
4. To know the direction of the wind
5. Idea of evaporation of water
6. Reasons for shadow not being formed in dark

5.3. *Comparison of Formal Rural (FR) and Non-formal Rural (NFR) groups*

The number of subjects, the mean scoures, S.D. and t-value of these two groups are given in Table VII.

TABLE VII

Comparison of FU and NFR groups

Sub-groups	*N*	*M*	*S.D.*	*t*
FR	20	38.70	6.93	NS 0.056
NFR	60	38.78	4.90	

NS indicates not significant.

It is quite clear from the t-value that there is no significant difference in the awareness of environment of the children of these two groups. The reason being that there is not much difference in their environment. However, there are some points of differences in their awareness towards different aspects as indicated in Tables VIII and IX. The students of NFR group were found to perform better in these aspects: shape of the earth, which water is safe for drinking, birds which do not make nests, different sources of water, the reasons for being dark at night, relationship between rocks and stones and the metals used for making a magnet. On the other hand, the children of FR group were found to score more in the aspects of: edible portion of a tomato plant, living place of a dog, shape of the teeth, the animals which do not eat grass, rotation of the moon round the earth, the reasons for shadow formation in light and the reasons for giving boiled water to the patients. There may be a few reasons for these differences, the main reason being that at the NFE centres the main emphasis is on teaching through environment and activities based upon the local specific materials. These might have increased their awareness towards some of the aspects like different sources of water, water which is safer for drinking and relationship between rocks and stones, etc.

On some of these aspects, the performance of both the groups was found to be equally good and are listed in Table VIII. However, in both the groups of rural stream, comparatively a large number of areas have been identified in which the awareness of the students has been found to be inadequate. These aspects include prevention of rusting of objects, different eating habits of animals, shape of the earth (application part), idea of evaporation of water, to find out time in watch, relationship between rocks and soil, the role of bone skeleton to give a definite shape to the body and the ways of knowing the direction of the wind.

TABLE VIII

Comparison of FR and NFR on the basis of first ten ranking aspects

S. No.	*Environmental Aspects*	*Direction of Difference (+, —)* *FR*	 *NFR*
1.	The edible portion of a tomato plant	+	—
2.	The living place of the dog	+	—
3.	Shape of the teeth	+	—
4.	Animal which does not eat grass	+	—
5.	Shape of the earth	—	+
6.	Water which is safest for drinking	—	+
7.	Birds which do not make a nest	—	+
8.	Sources of water	—	+

Common Aspects Amongst First Ten

Both FR and NFR groups did equally well on the following aspects:

1. Source of getting cotton
2. Physical characteristics of a newly born child
3. Direction of sunrise
4. The animal used for watching the house
5. Effect of weather on the growth of plants
6. Source of getting wool

Common Aspects Amongst Last Ten

1. Prevention of Rusting

TABLE IX

Comparison of FR and NFR on the basis of last ten ranking aspects

S. No.	*Environmental Aspects*	*Direction of Difference* (+,—)	
		FR	*NFR*
1.	Reason for being dark at night	+	—
2.	Relationship between rocks and stones	+	—
3.	Metals used for making a magnet	+	—
4.	Rotation of the moon round the earth	—	+
5.	Reasons for shadow not being obtained in the dark	—	+
6.	Reasons for giving boiled water to the patients	—	+

2. Relationship between rocks and soil
3. Shape of the earth (application part)
4. Idea of evaporation of water
5. To find out time in a watch
6. To know the direction of the wind
7. The role of bone skeleton to give a definite shape to the body.

6. *Interpretation of Results and Implications for Curriculum Development*

It is evident from the data presented in this study that the students from all the three groups have general awareness about such aspects of environment as the physical characteristics of a newly born child, effect of weather on the growth of plants, source of cotton and the animals used for watching the house.

The awareness regarding rusting and its prevention, evaporation, application part of knowledge and shape of the earth and direction of the wind is found to be rather poor amongst the subjects of all the three groups, irrespective of difference in their environments. All these aspects involve application part of the knowledge and critical thinking which appear to have not yet developed among those children who are in the age group of 10-11. These aspects of environmental knowledge require a certain level of formal reasoning which, according to Piagetian stages of mental development comes between the ages of 11 to 15. The children on whom this study has been focussed are in Piaget's stage of concrete operations (age seven to twelve). According to Watts (1969), "One argument about the use of the environment is that it facilitates interaction with concrete objects, that this is clearly appropriate to Piaget's phase of concrete operation." Close examination of those aspects of the environment on which children of all the three groups have performed poorly require a certain amount of formal reasoning which is based upon 'hypothetical' and 'propositional' thinking. Since the children of our study are not yet in the appropriate age group, the reason of their poor performance is understandable. The study has further established that the children have shown knowledge and comprehension of certain environmental aspects but are unable to apply fully their knowledge to understand the divergent aspects of their environment.

The study has implications regarding the organisation of curriculum at elementary level. Watts (1969) has classified objects into ten categories on the basis of their degree of concretness: observable and movable objects in the open; objects accessible but not movable; objects movable, but only if taken from their natural state; objects movable, which can be kept in something like natural state; objects observable only in museums, galleries and exhibitions; real objects which are kept in the home, school or classroom; models of observable objects; models of non-observable objects; and two dimensional representations of real objects, and situations including local material and three dimensional non-representational apparatus. Concrete objects falling in some of these categories based upon local environment may be incorporated both in the formal and non-formal school curriculum.

References

1. Grewal, J.S.; Bhargava, S.N.L.; Learning Through Environment. The report of the Orientation-cum-Production Workshop for the Field Workers of Non-formal Education and Writers, Regional College of Education, Bhopal, 1981 (Mimeographed).
2. Bhargava, S.N.L.; Grewal, J.S.; Pandya, M.C.; Gupta V.P.; On Natural Environment. In the Report of Orientation-cum-Production Workshop for the Field Workers of NFE of Gujarat State, Regional College of Education, Bhopal, 1981 (Mimeographed).
3. Jadhao, V.G.; Saxena, A.B.; Rajput, J.S., The Efficacy of Teaching Through Environment at Primary Level, *Journal of Indian Education*, Vol. VI, No. 4, November, 1980.

4. Rajput, J.S.; Saxena, A.B.; Jadhao, V.G.; Awasthi, Renuka; Teaching Through Environment, *The Primary Teacher*, Vol. V, No. 2, April, 1980.

5. Rajput, J.S.; Saxena, A.B.; Jadhao, V.G.; Environmental Questionnaire, Regional College of Education, Bhopal, 1980 (Mimeographed).

6. Watts, D.G.; Environmental Studies, Routledge and Kegan Paul Co., New York, 1969, pp. 58-60.

Integration of Environmental Education into the Curriculum of High Schools

DEEP PUNIA,[*] RAM KUMAR PUNIA[**] and SALILESH DARSHAN[***]

In this paper need for environmental education in schools has been emphasised and an attempt is made to integrate the components of environmental education into the curriculum of high schools. The objectives of teaching methods applied in high schools have not been altered, but in accordance with the premises like learning language, mathematics, history, geography, physics, chemistry, agriculture, drawing etc. and example of integration of environmental education in each area of teaching is presented. Micro level analysis of subject matter and integrating component of environmental education is needed. "The world does not satisfy man", Lenin wrote, and "man decides to change it by his activity." The propagation of congenial biological environment signifying water, air, food, shelter, clothing and protection against vectors of diseases, no wonder, has been recognised even from prehistoric days, to be fundamental and basic to individual existence. It has been increasingly realized that enviornmental hygiene provides the most permanent and economical protection against the many of the serious diseases. Alongwith the ecceptance of the principle it is inevitable to bring forthe into the lime light the present status que of the environmental quality which is deteriorating day by day.

Fifty-six percent of our urban population is concentrated in 142 big cities (100,000 and above). Present trends of urbanisation and industrialisation have particularly aggravated the problem of environmental pollution. Cordition is also not so good in rural areas.

Different Aspects of Environmental Pollution to be Attended

With the industrial advancement, air pollution is becoming a serious problem in cities and towns in India. Even in rural areas within the home, the discomfort and harm caused by burning leaves, cow dung cakes and smoke emitting fuels is a serious hazard to the lungs and eyes making the individual susceptible to irritation and infection of both the lungs and eyes. Dust is another important air pollutant in rural areas besides the use of new agro-chemicals in new agricultural strategy.

---

[*] Assistant Scientist.

[**] Assistant Professor, Rural Sociology.

[***] Assistant Rural Sociologist in the Department of Sociology, Haryana Agricultural University, Hissar 125004 (India).

More than 100 pollutants arising from different sources are added into the atmospheric air. Some are very toxic and those needs attention are:

1. Gases and vapours such as carbon monoxide, sulphur dioxide, ammonia and organic sulptides, aldehydes, acetones and aromatic hydrocarobons.
2. Fumes as of land and other chemical with particles of size 1 micron or above.
3. Dust suspended in air such as grit soot, arch, sand, pollens, fibres, etc.
4. Radio-active dusts and isotopes.
5. Smoke—Physically it is an aerosol with particles of size below 0.5 micron. Chemically it consists of:
    (a) Unburnt carbon, Co Co_0 No_2 NH_3 HNO_3 SO_3 H_2 So_2 and mercapton.

    (b) Proligenous acid and acetic acid especially when it arises from wood.

    (c) Hydrocarbons, naphthalene, paraffin, aromatics, asppliatts pyrene, anthracene, phencinthrene, benzpyrene, chrysene (last 5 are well known caracinogens).

Water

Water forms the second most important part of environment which needs the attention of educationists. Supply of safe drinking water to people has been a menacing problem before the nation. But the major aspect of this problem is the pollution of water. The main source of water supply—rivers are being polluted by the waste material of industries and cities. The magnitude of water poltution is increasing with industrialisation and unhealthy planning for disposal of waste material from all sources. Ocean on the other hand is being polluted by the water from these rivers and garbage of post cities and industries. Besides his bigger sources of water, even the immediate sources like wells and ponds are also being polluted, if not by bigger sources, at least by the habits of community. This aspect of environment needs immediate attention for providing health for all.

Food

Man is a mass of proteins. (Muscles built upon minerals (bone), protected by fat (adipose tissue) energised by carbohydrates and activated by vitamins. Food adulteration i.e. food pollution, may cause many diseases. Pollution is also of various types.

Diseases due to naturally present poisons in plants and animals such as mushrooms, ergot, kesri dal; shell-fish; water henoc and due to selenium in wheat may cause death or deformation. Other losses might be due to chemical poisons of food which may be accidential as in use of insecticides like sodium fluoride (N_aF) to kill cockroaches, ants etc. as poison resemble flour and rats may mix such poison with flour; due to adulteration e.g. edible oils are adultered with mineral oils and argemone oil; done with malice (homicidal) as mixing of arsenic in milk or other food or with a forethought (suicidal) as taking of potassium cynide or diazinon etc.

Newly emerging are of food pollution is the indiscriminate use of agro-chemical by farmers for increasing crop production. It is estimated that D.D.T. level in our body is much higher than tolerable extent. It pollutes, air, water, soil and food. In agricultural education special attention be given to this aspect of pollution.

Soil

Soil means the ground an environment may affect health and transmit disease if it is polluted with causative agents—physical, chemical, bacterial which are added with all sorts of wastes dumped on soil.

Chemical agents like pesticides, insecticides, herbicides and fungicides used in agriculture may pollute the soil. They may be transmitted to man with water and vegetables. Common ones are D.D.T., pindane aldrin and dielotrin which are found commonly. Soil pollution have an adverse impact on soil structure and fertility.

Noise

"Wrong sound, in the wrong place, at the wrong time". 20th Century has been described as the "Century of Noise". Noise has become a very important stress factor in the environment of man. Sources are many and varied. These are automobiles, factories, industries, air craft, and domestic noises from the radios, transistors; all adding to the quantum of noise in daily life. Noise exposure may cause autidtory fatigue, defners interference with speech, annoyance, efficiency and physiological changes.

Attention through Education

Now a days, other dimensions of human environment like ecological, social and cultural are increasingly claiming concern of the educationists, planners and administrators to promote wholesome congenical environment, hence, propagation and promotion necessitates appropriate media i.e. education. Environmental education thus means to create an awareness among the students about environmental problems. Young students as future citizens must know their environment, its uses and how to improve it.

The basic purpose of introducing environmental education in the curriculum or integrating it in curriculum at the school level is to enable the students to understand the nature of complexities of environment and to develop a right attitude and habits towards it. Their exposure in the early stages of life is expected to help the young pupils to imbibe and pursue such activities in future which may not be injurious to their environment. It must also help to create an understanding and awareness among students of the interdependence between economic, political and ecological aspects of modern world. It may enhance a spirit of responsibility and solidarity among nations also. It may also help the students to adopt self restrain to save environment and teach others, the quality of environment and teach others, the quality of enviornment from this stand point, environmental education is essentially an interdisciplinary area and needs to be discussed the curriculum.

The learning process calls for taking into account those situations in the curriculum which are familiar to the learner in his home, community and nation especially in environmental education. This would help the learner to solve his immediate problems.

The major goals of environmental education as discussed in the inter-governmental conference on Environmental Education organised by the UNESCO in co-operation with UNEP at Tbilisi (USSR) from 14-26 Oct. 1977 are traced below which have been taken into consideration while integrating environmental education in curriculum of high schools.

(a) To foster clear awareness of and concern about, biological, economic, social, political and ecological interdependence in urban and rural areas;

(b) to provide every person with opportunity to acquire the knowledge, value, attitudes, commitment and skills needed to protect and improve the environment.

(c) to creat new patterns for individuals group and society as a whole towards the enviornment.

Integrating the Component of Environmental Education

High school courses in this State includes subject like English, Hindi, Mathematics, Physics, Chemistry, History, geography, animal husbandry/agriculture, general science, drawing and sanskrit. There is option among different subjects at high school level. Whatever the teaching methods —lecturing, andovisnal acids, demonstration or group discussion—applied, the objective should be learning the subjects offered to a student. The element of environmental education can be integrated upto the present syllabus. Some examples in this respect are given below for each subject without changing the scheme of chapters and overloading the student.

Languages: Hindi and English are compulsory languages in the State. Besides, many students offer Sanskrit or Punjabi. All languages have three main parts (a) Vocabulory (b) reading and writing and (c) grammer. In vocabulary, terms pertaining of environment e.g. pollution, eco-system, habitat, defrostation, etc. etc. should be introduced. These can be easily introduced by either adding new chapters on the aspect or by increasing emphasis on environmental education in chapters in text books e.g. on poetry-poem on environmental conservation or praise of natural environment can be introduced.

Material pertaining to pollution of environment in terms of air, water, soil can be introduced in the chapters on invention and discoveries; the coal and minerals etc. etc. Stories can be introduced about the consequences of bad environment. Similarly element can be integrated with dramas.

Papers dealing with grammers are much useful for this purpose. Essay on different aspects of environment, stories and letters telling about the complexities of our immediate environment be introdueed.

History: What was the state of environment during each ruler or period as the case may be? What impacts the deterioration of environment has left on our civilization. How environment contributed to rise or fall of civilizations? How our environment has deteriorated? These are some of the questions which can be safely integrated with existing syllabus of the subject history.

Geography: Much of the course content can imbibe information on environment. Chapters on natural resources might be sufficient to integrate the message, as these deals with water, soil, forests and other resources. Ecological balance, afforestation, process of deforestation etc etc. can be included in the subject matter of geography. Economic geography can have a great deal with information in environment.

Mathematics: Notion of quantity and number can be used for calculating the extent of environmental pollution of air, water and soil. Units of measurement and numericals on it can be given for exercise. Ration, average and other type of mathematical properties can be taught by citing examples from environmental studies. In geometry, measures of capacity in relation to air, water etc. etc. Questions on population growth can be formulated in terms of ecological aspects.

Physics: Under the properties of matter, all type of pollutions and their control can be discussed. Materials used for sanitation and hygiene can give an insight of the problem.

Chemistry: What are the different chemicals work as pollutant in environment? How much of the chemicals are there in air? The process of air and water purification can aware the students which is being taught at high school level. Decomposition phenomena and how it affects the environment explains the processes.

Agriculture

It is very wide subject and the element of environmental education can be integrated in topics pertaining to soil erosion, agrochemicals, forestry, animal husbandry, social aspects of environmental developments environment and economic development etc etc.

Drawing

Natural sceneries depicting healthy environmental preparing posters and charts for disseminating environmental education be emphasised.

What is mentioned under each subject is not all which can be integrated with environmental education. In each subject analysis of each chapter is a must and an environmental educationist be involved in revising the books prescribed by the School Board of Education, Haryana.

References

1. Annonymous 1978. Environmental sanitation. Haryana Health Journal, 1x, (30): 25.28.
2. Annonymous 1981. Health for all: An Alternative Strategy. Swasth Hind. xxv, (3&4): 83-86.
3. Bajaj, I.D. 1981. Better Health Services of the people, Swasth Hind, xxv, 3&4: 69-70.
4. Cnandra, R. 1978. Need for environmental education in Schools, paper presented at workshop on Health, Disease and environment, New-Delhi, 6-8.
5. Devi, G. 1974. Health environment—the Human approach. Swasth Hind, xviii, 8, 212-214.
6. Food and Agriculture Organisation, 1973. Food and Nutrition education in the primary school. Food and Agriculture Organisation of the United Nation, Rome, Italy.
7. Saushkin, Y.G. 1978. Population and environment. The theory of population. Progress publishers, Union of Soviet Socialist Republics, Moscow.

Environmental Education in Teacher Training Programmes

M.V. RAMJI and A.L.N. SARMA*

"The contemporary world has witnessed unprecedented economic growth and technological progress which, while bringing benefits to many people have also caused severe social and environmental consequences" (Podoinitsin, 1977). The environment is fastly getting deteriorated on a world wide scale because of the great technological strides and industrialization in a relatively small number of nations. The United Nations declaration for a new International Economic Order called for a new concept of development which takes into account the harmony between the humanity and the environment. The environment is not to be construed as simple biological and physical resources only. It is a composite situation of natural and human resources. The greater we understand this concept, the easier it will be to develop a proper environmental education programme. Today, environmental education is essential and indispensable to combat and control pollution, over population and misuse of natural resources. Environmental education (EE) is a process of reckoning the values and elucidating the concepts so as to develop skills and attitudes needed to understand the surroundings. EE also incorporates practice in decision making and self-formulating a code of conduct regarding the matters of environmental quality.

Environmental education in the developing countries, though comparatively of recent origin from both curricular and extracurricular point of view, will be received with tremendous interest both within and outside the school because of its impact on the society itself and the crisis we may be facing shortly. EE today imposes rather different roles for educators. Traditionally the educator is the "decision-maker" regarding all aspects of curriculum (content, methodology and implementation in school and class room). EE involves better equipped persons other than the formal educators and teachers to work out the essential features and

---

P.G. Department of Life Sciences, Regional College of Education, Bhubaneswar, India.

problems of the environmental situation. Often the policeman, the carpenter, the blacksmith, the mason, the scientist, the bureaucrat or the administrator, youth leaders, social welfare organizations and the like would be other people in imparting certain aspects of EE. So, it is with the cooperation of these people and others that the teacher and the educator will work on environmental problems and situations and make these situations into learning experiences.

It is only in the recent years the human environment, with its varied problems and complex implications, has become the subject of topical importance and drawn the attention of international bodies, governments and the general public. The Belgrade Charter—a major outcome of 1975 workshop on the EE—drew the attention of different nations for a need to evolve environmental education. Awareness of environmental problems, knowledge to deal with the problems, developing new attitudes towards environmental problems, developing skills for such problems, providing evaluation ability of the environment, increasing the participation and involvement of the people in solving environmental problems are the main features of this charter. The environmental problems embrace a range of fields such as psychology, sociology, biology, anthropology and education. All these are of crucial significance in dealing with environmental problems.

UNESCO greatly endeavoured to draw attention to the environmental problems of the different regions of the world. Further, it engaged itself in supporting and implementing several projects to ameliorate the environment of the present generation. The International Biological Programme (on Man and Biosphere) and the Intergovernmental Oceanographic Commission are the major projects of the UNESCO to deal with environmental problems. The United Nations Conference on the Human Environment held in Stockholm in June 1972 formulated many programmes to evolve EE. The concept of environment as was understood by this Conference covers the problems of urbanization and development of natural resources as well as problems of pollution and conservation of species. The UN Environmental Programme with its headquarters at Nairobi (Kenya) was seized with the promotion of international cooperation in the environmental field and kept under review the world 'Environmental Situation'. It resolved to develop the aquisition, assessment and exchange of environmental knowledge.

Environmental Education Programme (EEP) is the recent initiative of UNESCO in cooperation with UNEP. The main objective of this programme is to enlist all the resources in the UNESCO Secretariat and to develop a overall framework for Cooperative International

Programmes to further the environmental education globally. The African Regional Meeting on EE at Braizeville, Congo (1976), the Asian Regional Meeting on EE at Bangkok, Thailand (1976), the Arabic States Regional Programme on EE at Kuwait (1976), the Latin American Regional Meeting on EE at Bogota, Columbia (1976), the European Regional Meeting on EE at Helsinki, Finland (1977) have made important recommendations for the promotion of EE at all levels. The Intergovernmental Environmental Educational Programme held in Tbilisi, USSR (1977) was very much concerned to formulate the recommendations at the national, regional and international levels for the promotion and development of EE.

It is pertinent that the developing countries like India must draw many a lessons from the developed industrialised Western world regarding the deteriorating environmental quality. We should lose no time in preserving the good earth on which we live, the air we breathe and the water we drink free of pollution. Otherwise, we will be responsible for the future articulate of the process of evolution commenting on the fate of human race as we do comment on the dinosaurian brutes of the Mesozoic era. It is through education-inculcating an awareness and consciousness of the environment right from the school-going age—that we can hope to save our environment. The children are the promising future potential of any country on whom the fate of a nation depends including the right quality of environment. Invariably, stress should be made on environmental problems of local, regional and national situation. This should stress upon population explosion, pollution, conservation and judicious exploitation of the biosphere and its components viz. lithosphere, hydrosphere and atmosphere vis-a-vis global situations. The Indian environmental scene and the current trends in Indian environment were appropriately envisaged and envisioned by the NCBRT. It lost no time in making a humble beginning with EE at the primary school level and inculcated in school going children ideas of preservation and conservation of the environment. The environment is used to teach fascinatingly science and social sciences. This approach indeed made learning more meaningful and charming for the learner.

However, there is a dearth of teachers and teacher educators to handle EE in its wider concept as they lack the expertise and correct training in environmental problems. In view of this, the curriculum for teacher preparation for school, collegiate and university education must invariably be modified and include ecology—the Environmental Science of Survival.

Knowledge of the classification of the environment, resources of the environment, exploitation of the environment, environment in relation to society, environment in relation to industry, society and industry in relation to pollution of the environment, maintenance of ecological balance, preservation and conservation of environment must form the core of EE at various levels of education. The quantum of contents instilled under these heads has to be appropriately dealt with at various levels of school and collegiate teacher preparation education.

In the present paper certain ideas on the environmental education curriculum development meant for teacher training programmes are presented alongwith strategies to be deployed both in the formal and non-formal educational systems. A model curriculum working paper is developed and salient features are presented below for the formal system.

The curriculùm should emphasise on the problems and perspectives of the EE in which the global dimensions of the environmental crisis are to be highlighted. The aspects of industrialization and urbanisation resulting in creation of imbalances in the atomsphere, hydrosphere and lithosphere of the Indian environmental scence are to be dealt with. Atmospheric pollution caused primarily by smoke particulates and sulphur dioxide deserves special mention. Problems of water pollution mostly through non-toxic organic wastes, human sewage, thermal pollution (hot water being discharged into river) and of toxic pollutants mostly of industrial origin must be reviewed. Organic pollution by and large is caused by urbanisation whereas thermal and toxic pollution result out of industrial activity.

Marine pollution resulting from river run-off and from direct dumping of wastes in the sea deserve special emphasis in the curriculum. Pollution of the land arising from atmospheric fallout and through dumping of solid or liquid toxic wastes on the earth's crust should be included. Apart from traditional aspects of environmental impacts some are of direct concern to the human—say noise pollution originating from motor vehicles, aircraft and machinery. This aspect of health hazard is one of the problems of contemporary 'civilized' environment and should be emphasised.

The long term impact of industrialisation in terms of ressource depletion is a matter of current and future political significance. To put it more bluntly, the resource depletion of the non-industrialized nations, caused by industrialized nations, of their readily available resources is a blatant exploitation by the rich industrialized world. The political significance of this need not be overemphasized or underestimated. With reference to the Indian environment, particularly the changing face of rural and urban scenes registering an alarming growth rate of populations has to be given special attention. Cities like Madras, Bombay, Calcutta and Delhi are experiencing a very fast rate of population growth. It is becoming increasingly established that metropolis like Delhi is going to be one of the choking and repellent cities of India. Calcutta is beyond repair at least in this century. This aspect of urbanization in Indian scene merits incorporation in the curriculum. The sulphur-dioxide and suspended particulates in the air in major cities of India (Ahmedabad, Bombay, Calcutta, Delhi, Hyderabad, Kanpur, Madras and Nagpur) should be an eye opener in studying the gravity of air pollution.

The second aspect of EE must deal with the alarming increase of countless heads leading to population explosion in the Indian environment. This sub-continent occupies 2½% land of the whole world but sustains 14% of the world population. This contrast of comparison of land: population must give a fairly clear picture about the complexity of the problems caused to environmental situation. On an average in every 1½ seconds there is a child birth in this country. One must be able to appreciate the population growth and its impact on economic growth. Population and pollution problem in EE is of crucial significance.

The third aspect of EE is the energy crisis rampant throughout the world and particularly so in the developing countries. The fossil fuels, the product of geological activity of bygone millionia of years are getting fastly depleted. These are non-replaceable and non-replenishable. Development and energy input are inseparable. According to an optimistic view the fossil fuel resources of the world will last for another 400 years and according to pessimistic (or realistic?) view they will last for about 23 years in accordance with the present demand growth rate. As such the need for alternative sources become imminent. Alternative energy sources are to be considered for averting an environmental energy crisis. The energy-rich fossil fuels when removed from the earth's crust are not replaced by suitably rich components but energy-poor effluents are only retained in the environment thereby causing serious impulses in the environment. The solar energy, the wind power, the water power, the animal power and the biomass of plants are come of the useful areas for energy harvesting. The nuclear energy and the environment should carefully be viewed and appropriate premonitions should be given. The problems associated with the Indian urban scene regarding water supply, sanitation and health and the waste disposal merit inclusion in the curriculum.

The pollution education must consider the microbial pathogens and public health; and hazards of pathogens and the epidemiological criteria should be given appropriate emphasis with reference to Indian environment. Diseases associated with polluted drinking water and recreational use of water must be reviewed in the syllabi. Diseases due to pollution of air, contamination of food and sewage must find a proper place in the syllabus.

A knowledge of the seas which cover 7/10 of earth's surface influencing the meteorology of inland terrain and governing the monsoonal systems of the peninsula is to be instilled in the framework of the curricula. Further, marine pollution in context of upsetting the bioeconomy of the seas must be duely considered. The domestic sewage, the oils, the radioactive materials, the chlorinated hydrocarbon like DDT, PCB let out into the marine environment and the consequences of such a tampering with seas are to be lucidly incorporated in the curriculum. The sources of pollution and pollutants in the sea (biodegration, accumulation and sedimentation in the sea), the evil effects of marine pollution such as eutrophication and the remedial measures such as pretreat of sewage and effluents are to be given specific importance alongwith the physical, chemical and biological properties of sea water and the effects of pollutants on short term and long term basis. The harmful effects of pollutants to humans and other animals on whom the man depends should also form an important item in the curriculum. At post graduate level of teacher training a higher quantum of information including the circulating pattern of oceanic currents, processes such as turbulance diffusion, decay rate and residence time, pathways of the pollutants, specific pollutants like pesticides, toxic heavy metals etc, their behaviour and fate in the environment must form the core programme in EE. Courses at each level must have a provision for appropriate demonstrations and practicals combined with field trips or excursions. The teacher training programmes in EE shall have to focus an environmental degradation and conservation.

Environmental deterioration and conservation is the most crucial aspect of EE. The shifting cultivation processes practised in different parts of the country gives a clear understanding of the conservation methods adopted traditionally. As such the tribal communities depending primarily on the shifting cultivation are to be given special emphasis with reference to states like Assam, M.P., Orissa and Mizoram.

Soil erosion, deforestation and floods are the main concern of the ecologist attempting the environmental problems of recent times. The fire ecology or ecopyrology is today accepted as a main branch of ecology and is gaining momentum. Information on effect of fire on grasslands and forests and use of fire in land management is available for the tropical and temperate ecosystems. The teacher training programmes should also include ecopyrology and the role of fire in range and wild life management with special reference to Indian region.

The causes and processes of desertification as seen in and around the tracts of Rajasthan may resolve some of the problems arising from desertification. The inherent climatic condition, geologic and geomorphological setting, are to be pinpointed in explaining the desertification. The soil erosion (sheet erosion, rill erosion and gully erosion) and its causes (distribution, intensity and amount of rainfall, slope of the ground, vegetation cover etc.) and the consequences of soil erosion (shortage of timber, fuel, fodder, loss of soil stability and fertility, high temperature and low rainfall, greater frequency of floods etc.) and the national importance of this problem should be stressed. Methods for controlling the soil erosion (mechanical and biological methods) shall have to be imparted to teacher trainees to impress efficiently on target groups i.e. primary, middle and higher secondary students.

The brackish water ecology of the country (Lake Chilka of Orissa, Rann of Kutch in Rajasthan, Point Calimere of Tamil Nadu, North Salt Lake of Calcutta, Khaldeoghana Birds Sanctuary, Bharatpur, Rajasthan) must form a part and parcel of EE as they are the productive pockets of the biosphere. The term wet land must be clearly understood as low lands covered with shallow and sometimes temporary or intermittent water. The management of bogs, swamps and other coastal systems which fall under wet lands must find a place in the curriculum. The problems of *Bichornia*, *Salvinia*, *Potamogetton* and *Hydrilla* which seemingly reduce the food and productive potentialities of our wet lands should also find a proper place in the syllabi. The paramount importance of floods, their cause, occurrence, consequences and controls must be realized and they should find place in the curriculum.

The curriculum must be so made to drive home the concept of environment. In short it means, totality of man's surroundings that is "The sum of all social, biological and physical or chemical factors which compose surroundings of man" (U.S. President, Science Advisory Committee, 1965). This definition would enable one to understand the concept of environmental management.

Apart from the formal EE, attempts should also be made to develop non-formal EE to develop adequate environmental awareness and concept of environmental management. In this regard the orientation of development officers (engineers, designers and administrative officers) must also be considered for the implementation of EE and environmental preservation. The orientation courses have to be necessarily of a multidisciplinary nature. The universities, the colleges and the teacher training institutes have to learn a great deal from the participants too who come with a lot of experience. The orientation programme must be a continuous process turning out adequate number of "environmentally oriented" workers. The objectives of EE curriculum in nutshell must enable people in recognising the values and clarifying concepts in order to develop skills and attitudes needed to understand and appreciate the inter-relations among the men, his culture and his biophysical surroundings (Deshbandhu, 1977).

The principles and practice of EE based on IES/IYE Workshop held in Hongkong are to be imparted to the teacher educators to interact efficiently with target groups. A model curriculum for the EE in the schools is appended herewith.

Charts depicting the role of NCERT in the Teacher Training EE programmes is given under with a suggestion for the establishment of an environmental education directorate or department both in Council and its RCEs which are involved in the quality teacher preparation programmes like M.Sc. Life Science-Ed., 4 Year Integrated B.Sc. B.Ed./B.A.B.Ed. Perhaps it would be more worthwhile if the core contents in the One Year B.Ed. training programmes is basically modified to include EE and methodology of teaching the same to 40 per cent of the syllabus, another 20 per cent to content and methods of teaching conventional science subjects and the balance or even less to pedagogy. Science faculties can organise correspondence-cum-contact programmes in EE for teachers in service. In these programmes, EE may be imparted through a special paper or a complete course streching over two semesters at various levels. This would enable in producing needed number of teacher educators and teachers with expertise both in theory and practice to teach the students.

The structure of the non-formal system of EE involving the orientation of developing officers is also depicted.

Likewise a chart on the possible role of the Universities in imparting EE among its constituent colleges is given.

Model Curriculum for EE in the Teacher Training Programmes

(i) Problems and perspectives of Environmental Education

- (a) Global dimensions of the environmental problems with special reference to Indian environment.
- (b) Principles of environmental science

(ii) Population and Environment

- (a) Population explosion
- (b) Population and pollution

(iii) Environmental energy crisis

- (a) Energy crisis
- (b) Energy and environment
- (c) Nuclear energy and environmental crisis

(iv) (a) Classification of environment

- (1) Urban
- (2) Rural
- (3) Tribal

- (b) Industrialization and urbanisation and environmental implications.
- (c) Environmental quality of Indian citizens.
- (d) Water quality, sewage, health and hygiene levels in urban environs.

(v) (a) Environmental pollutions

- (1) Organic
- (2) Inorganic and
- (3) Biological (microbial) pollution of air, water (fresh water, marine and brackish water) and land.

- (b) Pollution and public health.

(vi) Environmental degradation and conservation and maintenance of ecological balance.

- (a) Exploitation of the environmental resources (replenishable and non-replenishable)
- (b) Knowledge of the ecology and management of major

ecosystem of the biosphere including the wet land ecosystem.

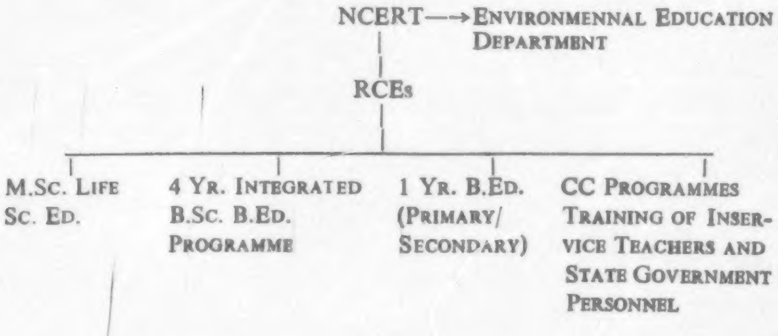
(c) Causes and ecological effects of shifting cultivation, ecopyrology and desertification.

(d) Soil erosion and its control.

(e) Flood and its control.

(vii) Principles and practice of environmental education (including formal and non-formal education system).

Environmental Education in Teacher Training Programmes


NCERT
ENVIRONMENNAL EDUCATION DEPARTMENT
RCEs
M.SC. LIFE SC. ED.
4 YR. INTEGRATED B.SC. B.ED. PROGRAMME
1 YR. B.ED. (PRIMARY/ SECONDARY)
CC PROGRAMMES TRAINING OF INSERVICE TEACHERS AND STATE GOVERNMENT PERSONNEL

References

Podoinitsin, V.C. 1977. Inaugural Address. pp. 1-6. In: *Current trends in Indian Environment*. (Proceedings of the Workshop of Environmental Education held at the Indian National Science Academy, New Delhi, July 11-12, 1977). Eds. Desh Bandhu and E. Chauhan. Today and Tomorrow's Printers and Publishers.

U.N. Conference on the Human Environment, Stockholm, 5-16 June 1972, Report A/Conf. 48/14 Rev. 1.

African Regional Meeting on Environmental Education at Brazzaville (The People's Republic of Congo), 11-16 Sept., 1976.

Asian Regional Meeting on Environmental Education at Bangkok (Thailand), 15-20 Nov., 1976.

Arab State Regional Meeting on Environmental Education at Kuwait, 21-25 Nov., 1976.

Latin American Regional Meeting on Environmental Education at Bogota (Columbia), 24-30 Nov., 1976.

European Regional Meeting on Environmental Education at Helsinki (Finland), 27-31 Jan., 1977.

Intergovernmental Conference on Environmental Education at Tbilisi (U.S.S.R.), 14-26 Oct., 1977.

President's Science Advisory Committee—Environmental Pollution Panel, 1965. Restoring the Quality of our Environment. Washington D.C. U.S. Government Printing Office.

Desh Bandhu, 1977. Principles of Environmental Education and how these can be implemented, pp. 215-218. In: *Current trends in Indian Environment.* (Proceedings of the Workshop on Environmental Education held at the Indian National Science Academy, New Delhi, July 11-12, 1977). Eds. Desh Bandhu and E. Chauhan. Today and Tomorrow's Printers & Publishers.

Environmental Education Programme for Schools—A Case Study

R.P. SHETYE and S.B. CHAPHEKAR

During the past few years the deterioration of the environment has become a major topic of discussion and also of controversy. It would, however, be a grave mistake to assume that it is only contemporary generations that have been concerned about the progressive pollution of air and water or the over-stretching of resources. The main difference now, as compared with even a few years ago, is that public opinion is at last beginning to support the enlightened individuals and organisations, who in the past have often campaigned for improvement of environment without receiving the backing and support they deserved.

The most unfortunate feature of the current concern is that in many cases it has almost reached panic proportions. As a result, many genuine problems have been distorted out of size and context. This is not to say that problems do not exist or that they are not serious. But the fact that so little has been done for so many years that a huge backlog of work has been accumulated and must now be dealt with urgently.

The Society for Clean Environment (SOCLEEN), Bombay, has played a pioneering role in the country in disseminating ideas about environment, environmental crisis and problems of population growth in a number of ways.

Mass appeal for environmental awareness, work in our own laboratories and generating collecting and compilation of data on facts about environmental deterioration, have been our main activities in recent years. In this connection, every year 'SOCLEEN' chose and pursued one topic of environmental concern. 1980 was the year devoted to Noise Pollution. The year 1981 was observed as the year for, "Creating Environmental Awareness Among the School-Going Children". Activities car-

Society for Clean Environment Garden Resort, 606 Sion Trombay Road, Chembur, Bombay 400 071.

ried out in 1981 programme are detailed below.

In order to impart the knowledge of different aspects of environment and possible solutions to the problematic situations and also to explore the imaginative power of the young, SOCLEEN in collaboration with Sane Guruji Vidyalaya, Dadar, carried out a number of programmes for the school-going children, in 1981.

About 350 Marathi medium schools of Bombay were contacted to participate in these programmes. The programmes included lectures, field visits, working projects and essay, quiz and painting competions. This is a pioneer attempt to impart environmental education in Marathi and must be rated as one of the very few where vernacular language is used as a medium to convey ideas in this field. About eighty students were selected from eight schools for the intensive educational programme. Besides, teachers from these schools also participated in this programme.

The Orientation Lectures

A series of five lectures spread over a period of two months was delivered to the students and teachers. An extended summary of each lecture was given to each participant as the basis for discussion, to follow fully illustrated lectures. The topics covered were—(1) Environment and balance of nature, (2) Various types of environmental pollution, their ill-effects and means of controlling pollution, as well as (3) The impact of human population on ecosystems. The lectures and discussions enabled the students to become more receptive to environmental problems during their subsequent field trips and working on environmental projects.

The Field Trip

The participating students and teachers were taken on a field trip to a few selected industrial areas requiring immediate environmental improvement. During this trip the students saw the ill-effects of environmental pollution, which included things like vegetation and property damage, odours of foul air, polluted water and contaminated soil. The students also interviewed some of the residents in these affected localities to know more about the ill-effects of pollution. The impression of these students after visiting Old and New Bombay industrial areas was that Old Bombay was a concrete jungle, while New Bombay had the repulsive look because of bald, barren and extensively quarried hills and lack of greenery. During this trip, participants also learned about pollution monitoring technique. They were shown the mobile Air-Pollution Monitoring van of Rashtriya Chemicals and Fertilizer Ltd. at Chembur. An extensive round inside the premises of the RCF and visit to their liquid effluent treatment plant enabled them to learn about the methods used for pollution control and recycling of water.

Investigative Projects

These intensively trained school students studied, discussed and took necessary steps to work out small projects, within their residential areas or around schools and submitted project reports towards the end of the programme. The projects included:

1. Collection of suspended matter in domestic water supply and examining its physical characteristics like colour, size, frequency, etc., on the basis of observations through microscope.
2. The types of trees, its number, height, health in terms of foliage and colour and dust deposited on leaf.
3. Details of industrial activity in selected locality and environmental problems created by it.
4. Study of vegetation by transact method.
5. Dustfall measurements and classification of dust particles by use of microscopes.

Competitions

The quiz, essay and painting competitions on various aspects of environment were held for school children. The topics given for these competitions were as follows:

Painting Competition

1. Increasing population
2. Pollution and health
3. Destruction of forests

Essay Competition

1. Food Adulteration
2. Industrialization
3. Noise pollution
4. Energy
5. Conservation

Around hundred schools of Bombay sent their selected students for these competitions. The competitions revealed different ways of viewing the environmental problems by the young inquisitive minds.

Many educational, social and environmental institutions in different parts of the country have shown keen interest in this programme and have expressed their desire to carry out similar programmes in their regions.

This movement should spread in many directions from this essentially 'conservationist' base. Different NGO's should start attacking different targets with relevant priorities. Many communities have come to realise that the appalling environmental conditions they often have to tolerate are not inevitable and that change for better environment is possible. Ambitious projects need to be undertaken to spread this understanding about the environmental problems to succeed in corrective measures to be implemented on a large scale.

The interaction with young minds during these programmes have given us many thoughts for future work. Young students have shown a great interest in field work and have expressed their desire to do something practical to improve the quality of environment. In view of this, SOCLEEN is planning to publish a booklet on Environmental Education for Schools. The publication will carry details on various aspects of environment, quiz questions, topics for essay and painting competitions and the types of environmental projects which were carried during the present programme. Possibilities of adoption of the programme according to different local conditions will also be discussed. We hope that this will be a guideline for organisations interested in similar programmes.

An Experiment in Implementation of Environmental Approach at Primary Level

DR. J.S. RAJPUT, DR. A.B. SAXENA and DR. V.G. JADHAO*

Introduction

A project was undertaken at Regional College of Education (NCERT), Bhopal to test the efficacy of the environmental approach. Using environmental approach in teaching entails the assimilation of the following components in the curriculum according to the stage of mental development of the child:

(a) Developing positive attitude towards environment

(b) Relating the concepts with the local environment and resources

(c) Attempting to develop empathetic relationship with different members of community and understanding their role and importance

(d) Making use of easily available material from the local environment for conducting experiment, demonstrations, discussions, etc.

In accordance with this, it was necessary to prepare the curriculum according to the local environment to find out the practicability and feasibility of approach. As a first step, it was decided to identify the use of environment in the core curriculum weaving learning around the child's natural and familiar environment.

Regional College of Education, Bhopal.

Based on 'The Report of Project Environment' (An ERIC Project), Regional College of Education (NCERT), Bhopal, 1980.

Strategies and Methodologies

The project team studied the syllabi of primary level in detail and divided the topics into smaller units, made rearrangements wherever necessary and prepared a sequented list of sub-topics. In doing this was always kept in mind that the environment is to be used as a means to an end and the child should be able to work out solutions to the problems the child is likely to face in life. A compilation of the list of resources such as agriculture products of a particular area, trees, plants, soil, etc. was prepared and this indicated certain broad patterns as well as the differences of resources in various regions. Involvement of primary teachers was considered necessary both at the preparation stage of the material and in suggesting and finalising the activities. Finally the instructional materials for classes III to V was prepared within the broad framework of concepts, teacher pupil activities, environmental aids, concepts related to other areas and also the help required from other sources including the community.

The Experiment

The material was tried out initially in some schools for finding out its practicability. Finally, it was decided to find out the efficacy of this material in two schools under strict experimental control. For this study, the following hypotheses were tested:

(i) When science is taught through environmental approach, the children do not score significantly higher in environmental awareness than the other children taught by existing curriculum and methods.

(ii) When science is taught through environmental approach, the children do not score significantly higher in the traditional examination than the other group of children taught by existing method and curriculum.

To measure environmental awareness of the children an environmental awareness test was developed and standardized on the relevant population of the other schools of Bhopal city. To test the two hypotheses mentioned earlier, test of significance was used. To obtain the achievement scores in the traditional examinations, the examination paper set for the session was used.

In order to test the hypotheses, the following steps were taken:

1. Two schools were selected at random for the purpose of this

study. From each school one section each of class III and class IV were selected at random as experimental group. Similarly, one section each of classes III and IV of each school was selected as control group.

2. The teachers teaching science in the experimental group were contacted and a copy of the curriculum prepared was also given to them for consultation. Before starting teaching, the control and experimental groups were administered the environmental awareness test. The time used in teaching science in the experimental group was as per the regular schedule of teaching and thus was kept equal in the two groups.

3. At the end of the session the control and experimental groups of classes III and IV from two schools were administered the environmental awareness test and the examination test paper.

Before the results are discussed, it is relevant to point out one important factor regarding the methodology of teaching and the significance of two hypotheses with regard to each other. It is well known that the existing method of teaching science largely consists of science book regarding writing a set of questions and their answers by the teacher and subsequently copying by the students. Knowing these very facts, it was decided to dispense with this method, instead, the teachers of the experimental group were persuaded to discuss the topic in the class, perform the activities using locally available material and noting down in brief the relevant points on the black-board (but no questions and answers for that purpose) in accordance with the principles of environmental approach. At this juncture it was found that teachers were afraid of low achievement scores in conventional examinations for the children of experimental group. It was decided to test this also alongwith environmental awareness.

Results

Hypothesis 1

The number of students in experimental and control group in Deepshikha and Sardar Patel Scools of Bhopal city are shown in Table I. Their mean score on environmental awareness test at the pretest stage is also shown in the same table.

TABLE I

	Class III		Class IV	
	Experimental group	*Control group*	*Experimental group*	*Control group*
(a) *Deepshikha School*				
No. of students	22	24	21	17
Mean score of Environmental Awareness on pretest	27.3	16.6	34.8	33.3
(b) *Sardar Patel School*				
No. of students	25	24	36	28
Mean score of Environmental Awareness on pretest	21.7	20.7	29.3	30.2

Table II shows the t-values between the scores of experimental and control group at pretest stage. It is found that only the control and exprimental groups of Class III from Deepshikha school had significant difference at 5% level at this stage. The causes of this difference could be many, one being the differing I.Qs. Therefore, we did not consider it proper to conduct our experimental study on this pair. All the remaining three pairs of classes III and IV of Sardar Patel and class IV of Deepshikha were not significantly different at 0.05 level and hence could easily constitute the sample of the present study.

TABLE II

t-values between the scores of experimental and control group at pretest stage

	Class III	*Class IV*
Deepshikha School	3.77	0.26
Sardar Patel School	0.33	—0.04

The Table III shows the t-values between the scores of experimental and control group at post-test stage

TABLE III

t-values between the scores of experimental group and control group at post-test stage

	Class III	*Class IV*
Deepshikha School	—	2.04
Sardar Patel School	2.07	0.17

Out of these, the one for class IV of Sardar Patel is lower than the t-value at 5% from the standard table. This shows that the two groups are not significantly different. In the remaining pairs, the experimental groups have scored significantly higher than the control group. Thus the hypothesis I is rejected in the two cases and accepted in one case. This establishes in two out of three cases that the scores of experimental group are higher on environmental awareness test than the control group at the post-test stage.

As a cross check we also found out if this significant difference has just occurred due to the maturing and other time factor involve during teaching. For this we calculated the t-values between the scores of pre-test and post-test scores of the same group experimental and control. The results are shown in Table IV. It is fair to do this exercise only for those groups which were equivalent at the pre-test and were found to be significantly different at the post-test.

TABLE IV

t-value between scores of environmental awareness pre- and post-test for the experimental and control group.

School	*Class III*	*Class IV*
Deepshikha	Not initially equivalent	Experimental: 2.41 Control : 0.67
Sardar Patel	Experimental : 1.49 Control: 0.2	Not significantly different at the post-test

It is very clear from Table IV that the experimental group in both the schools scored higher at the post-test relative to the pre-test whereas the control group scored not significantly different from the respective pre-test scores. This shows that the change in the environmental awareness brought up in the experimental group cannot be just due to maturity.

Hypothesis II

The mean of the achievement scores of control and experimental group and t-values on the traditional examination paper are shown in the Table V.

TABLE V

Mean achievement scores of and t-values between experimental and control groups

		Class III		Class IV	
		Experimental group	*Control group*	*Experimental group*	*Control group*
(a)	Deepshikha School				
	Mean scores	Not initially equivalent		30.1	26.24
	t-values			1.5	
(b)	Sardar Patel School				
	Mean scores	19.76	18.76	20.44	20.4
	t-values	0.09		0.02	

It shows that in all the three cases, the scores of the two groups are not significantly different, and hypothesis II is rejected. The doubt of the teachers is thus proved to be unfounded that not writing down the questions and their answers may bring down the scores in the traditional examination.

Discussion

The results show that teaching through environmental approach does increase the environmental awareness of the children. It also shows that if the curriculum is interesting, relevant to the children, it has more bearing to successful teaching rather than writing down question-answers. Thus this study is also an eye opener to the teachers who are afraid that if they do not dictate the questions and answers in the class, the children will not score sufficiently high in the prevalent evaluation system. In fact, what they need to do is to make the curriculum more interesting and relevant, give the children more chance to perform the activities using simple low cost/no cost material which they can pick up here and there. Perhaps this way the teaching will be more satisfying to the teacher and the children both. It is also felt that there is no shortage of time as is usually complained of. What is required is little bit of pre-planning so that things run smoothly and time is not wasted.

Finally it is relevant to point out here that although this study shown that the mean achievement scores of experimental and control group in the traditional type of examination are not significantly different, we do not mean that the method of evaluation need not be changed while adopting environmental approach. Review and necessary modification of evaluation system is an integrated part of any curriculum improvement programme. It was this reasoning which made us to take special permission of the District Education Officer, Bhopal for allowing us to evaluate the children of the experimental group by our own method of evaluation geared according to the dictates of environmental approach. These scores were mentioned in the report cards of the experimental group.

For a more comprehensive evaluation, a set of situations may also be provided to the children, where they may be asked to identify, react to and perform certain activities. On the basis of the child's reaction evaluation may be done. This part of evaluation may form a part of total evaluation apart from written test provided to them.

AUTHOR'S INDEX

Bandhu, Desh 283
Bhattacharya, Shakuntala 360
Biswas, Asit K. 57
Biswas, Margaret R. 57
Bowonder, B. 339

Chaphekar, S.B. 474
Chelliah, T. 178
Chelliah, T. 245
Chunkao, Kasem 225
Contractor, A.J. 333

Darshan, Salilesh 456
Das, R.R. 355
Davis, Craig B. 234
DeSilva, S.H.C. 253
D'souza, A.R. 390

Gill, J.S. 424
Grewal, J.S. 443
Gupta, V.P. 443

Jain, H.K. 85
Jodhao, V.G. 478

Kamel, Mohamed 275
Kamel, Mohamed 279
Kanwar, J.S. 69
Khatu, K.K. 390
Krishnamurtty, K. 417
Kwik, Tommy 164

Lamba, Davinder 270

Marton-Lefevre, J. 107
Merh, Sushma 380
Mishra, P.R. 433
Misra, R. 49
Mohd., Redha Saeed 194

Pal, B.P. 1
Ponniah, W D. 116
Punia, Deep 456
Punia, R.K. 456

Raharojo, Bedjo 169
Rajput, J.S. 443
Rajput, J.S. 478
Ramanathan, N.L. 339
Ramji, M.V. 463
Rao, Biswanath 348
Rashid, M.A. 365
Rathore, J.S. 398
Robinson, Michael H. 145

Sacks, Arthur B. 257
Sarma, A.L.N. 463
Saxena, A.B. 478
Sekar, T. 370
Seneviratne, Eardley W. 207
Shankarnarayan, D. 312
Sharan, B. 293
Sharda Prasad, H.Y. 101
Shetye, R.P. 474
Singh, C.P.N. 9
Singh, Jitendra 333
Smith, Diana Lee 270
Subramanian, R. 319
Sundaresan, B B. 324

Tanner, Thomas 234
Thacher, Peter S. 93

Ui, Jun 174

Varma, Rajni 355
Velasquez, Sr. M. Aida 200

Yuktananda, Swami 412